BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY

Vol. XXIV 1892 No. 2

THE FAYÛM.*

WITH

BRIEF REFERENCES TO RECENT DISCOVERIES IN OTHER PARTS OF EGYPT.

BY

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About sixty miles south of the great pyramid of Gizeh, the Libyan hills open and we enter a pear-shaped hollow. This district is called the Fayûm—a literal Arabic translation of the ancient Egyptian name *Ta Schet.* It means, "The Province of the Lake." When we first pass the abrupt entrance through the Libyan chain into the valley, that valley seems narrow, but it gradually widens out towards the west until it spreads itself over an amphitheatre more than a hundred miles in length and forty miles in width. In its centre rises a plateau, the general level of which is the same as that of the irrigated plain of Egypt. The dis-

* This lecture was illustrated by fifty-seven stereoscopic views.

MAP OF THE FAYOUM, SHOWING THE BIRKET-EL-KEROUN AND THE ARTIFICIAL 'LAKE MŒRIS.'

trict contains the most highly cultivated land of Egypt, and the famous remark of Herodotus that "Egypt is the gift of the Nile," more truly fits this province than any other. Its climate is delightful, and strange to say, malaria is unknown there. It is called "the land of roses," and as one alights at the railway station of Medinet el-Fayûm, thrifty children will offer, for a consideration, little bottles of the oil of roses. Nineteen hundred years ago Strabo wrote: "The Arsinoë province," *i. e.*, the Fayûm, "is the most remarkable district of Egypt, not only in respect of beauty of landscape and excellence of soil, but for its products. It is overgrown with large, symmetrical and fruitful olive trees. Its olive oil is known everywhere. The same is true of its wines, corn, pulse and other products." What Strabo said receives confirmation to-day. Its luscious oranges, mandarines, peaches, figs, pomegranates and grapes are second to none. I have been told by manufacturers in Manchester that the cotton of the Fayûm sells in the Liverpool market at the same price as our Sea Island product. Roses from this province profusely furnished the tables at the banquets of Cleopatra. To-day their wonderful hues would delight guests at anybody's banquet. Let one visit the Fayûm in November and he will see that the fame of its fruitfulness has been well earned.

At Medinet el-Fayûm, the capital of the province, a cheerful town of 25,000 inhabitants, is a station of the American Mission. A letter of introduction from the Mission House in Cairo will make one welcome to a family circle that speaks American-English, and loves the Stars and Stripes.

This oasis in the desert once supported a population of 200,000. To the desert it originally belonged partly, if not wholly, but by most skilful engineering was gridironed by canals and lakes.

To appreciate the importance of the Fayûm we need to study somewhat closely its history, internal improvements, natural resources and ruins. Of course it would be unpardonable to omit the testimony of the Greek and Roman historians and geographers, who saw the province in its glory.

First of all we should observe the record of Herodotus, who says that "Menes was the first human king of Egypt; that he was succeeded by three hundred and thirty sovereigns, but that no one monarch of this long series was distinguished by any act of magnificence or of renown except Moiris, the last of them all. It was he who built the northern propylæum of the temple at Memphis; he who excavated in the Fayûm a lake called by his own name, a work of great splendor and utility." Then, after describing the Labyrinth, and saying that it surpassed all the works of the Greeks put together in one, even the temples at Samos and at Ephesus, and the Egyptian pyramids too, he adds: "Wonderful as is the Labyrinth, the work called Lake Moiris is more astonishing still."

According to recent maps this lake region consists of two depressed basins lying west of the Nile, between Memphis and Beni-suif. "The lower of the two is as much as a hundred and eighty-one feet below the level of the Mediterranean." The most northern hollow contains a lake without an outlet—the Birket el-Kerûn. Herodotus says that "this artificial lake,

called after King Moiris, measured in circumference 3,600 furlongs (*i. e.*, 450 miles), equal to the entire length of Egypt on the Mediterranean Sea ; that it was filled with water brought from the Nile by means of a canal ; that the current set for six months from the Nile into the lake, and for the next six months from the lake into the Nile ; that while the water was running into the lake, fish worth a talent of silver ($1,060) was taken every day." Herodotus honestly believed that this lake was the greatest of all human achievements. It excited his utmost astonishment. It suggested to him that the greatest builders the world ever saw could not only scale the heavens in evidence of their power, but with the same daring courage and skill could go down into the bowels of the earth. If it really was an artificial structure, Herodotus had a right to be astonished ; but we cannot always trust him. He too easily believed what the priests told him. He believed them when they spoke of a king Moiris who never existed. Whatever excavations were made there, whatever engineering skill was displayed there, was due to Amenemhat III., of the brilliant XIIth dynasty ; contemporary, perhaps, with Abraham, if we accept the chronology, now generally, though not universally, adopted. Concerning Egyptian chronology the wise man will not dispute.

Whatever allowance we make for the credulity of Herodotus must also be made for Diodorus Siculus ; for he repeats substantially the same testimony and adds : " Because the Nile did not keep to a constant height in its inundations, and because the fruitfulness of the country ever depended on its just proportions,

the king dug this lake to receive such water as was superfluous, that it might neither overflow the land, and so cause fens and standing pools, nor by flowing too little injure the fruits of the earth for want of water, and cut a trench from the river into the lake fourscore furlongs long [ten miles] and three hundred feet broad. Into this lake he sometimes let the water run, and at other times diverted it, turning it over the fields of the farmer by means of sluices, but not without much cost and labor, for these sluices could not be opened and closed at a less cost than fifty talents." ($53,000.)

At El-Lahûn, near the gorge that gives entrance to the Fayûm, is a dyke which limits the amount of the flow. A fall of ten feet carries the water through the town of Medinet el-Fayûm. One branch runs north to the Tamieh, another, falling fifty feet in twenty miles, turns undershot Sakieh water-wheels, and is lost in the plain. The third canal is nearly the same as the ancient one. It winds west and south and is the principal affluent of the Birket el-Kerûn.

One fact has always perplexed those who would definitely fix the locality of the famous Lake Moiris. It is the statement of Herodotus that nearly in the centre of the lake there stood two pyramids, rising to the height of fifty fathoms above the surface of the water, and extending as far beneath, each of them crowned with a colossal statue sitting on a throne What and where these pyramids were is a question which nobody, till recently, has been able to answer. Mr. Petrie has given it his attention. After two days of digging at Biahmû, five miles from Arsinoë, he found two pedes-

tals, two hundred feet apart, which, at a distance, must once have looked like pyramids. The pedestals, of brownish limestone, had dressed faces on all four sides. Remains of a wall are still around each of them, enclosing a courtyard; also remains of a pavement of fine white limestone. There were once steps at the front and sides of the pedestals. One of these statues, as restored by Mr. Petrie, shows that it was not that of a sphinx, but of a man sitting, with his hands on his knees. Evidences of the *sam** on the sides of the pedestal were found together with stems and flowers, showing that the monarch claimed authority over both Upper and Lower Egypt. With regard to the height of this colossus, Mr. Petrie made an estimate from the few data he could obtain, and thinks that there must have been at least thirty-five feet between the seat of this statue and its head. The nose still exists, and is eleven and a half inches wide. It seems as though a man with such a nose as that should stand about seventy feet in his sandals. One statue was probably that of Amenemhat III., the builder of the pyramid of Hawara, the Labyrinth and Lake Moiris, the other that of his wife. These pedestals, then, are newly discovered testimony which helps us fix the location of Lake Moiris.

Twenty years ago Mariette Bey, in an address before L'Institut Égyptien, said: "We have found a papyrus representing a plan of Lake Moiris, which confirms the idea of Linant Bey thirty years ago. Lake Moiris was not where Birket el-Kerûn now is, but

* That union of two plants which are emblematic of Upper and Lower Egypt.

near Haûn and the gorge which gives entrance to the Fayûm. The plan is made with a religious aspect. The villages surrounding the lake are personified as divinities. Some of these towns can be identified, as Haûn and Hawara." This testimony of the papyrus agrees with the testimony of Herodotus with regard to the two pyramids or pedestals which Mr. Petrie has found. Mariette Bey adds that the lake could be made to cover about 80,000 feddans, or acres.

Mr. Petrie, an accomplished civil engineer, who has spent two entire winters in this province, says: "My own idea of the Fayûm history is that it is a marshy lake filled by the high Nile, and partly reclaimed during the XIIth dynasty. The dyke was constructed, not to let in, but to keep out the water from the high ground, while the main lake was fed by canals around the reclaimed land. In Greek times, when the water was limited, the lake sunk, and the lower lands were thus reclaimed."

Mr. Whitehouse says: "There is a large basin in the south of the Fayûm, excavated or eroded in the extremely friable nummulite limestone, over two hundred and seventy feet below the high water mark at El-Lahûn, and connected with the Nile through Bahr Yôuseef. It contains no trace of human habitation, bears in two places the name Meri or Moieh and resembles Lacus Meridis of the Ptolemaic maps. The Moiris basin includes all that part of Egypt lying south of Cairo, and west of the hill in which the ancient historians and geographers place the erosion or excavation formerly attributed to a mythical King Moiris." If we understand Mr. Whitehouse, he would say that

Lake Moiris filled three basins, viz.: Fayûm, Garag and Reian.

Others are equally certain that the depression which contained Lake Moiris was a natural one, by no means the work of man, but rather produced by a subsidence like that of the Dead Sea in Palestine. Prof. Maspero has recently said: "I no longer believe in a Lake Moiris. If Herodotus ever visited the Fayûm, it must have been in summer, at the time of high Nile, when the whole country presented the aspect of an actual sea. He took the embankments which divided the basins, and served as roadways between one town and another, for the banks of a lake. His story, accepted by old writers, has been repeated by our own contemporaries; and Egypt, which was not responsible for the story, has received from later ages the credit for a gigantic work, the execution of which would have been the glory of her engineers, had it ever existed."

Set over against this the fact that Lepsius found, high up the Nile, at Semneh, as well as in the Fayûm, a Nilometer, bearing the name of Amenemhat III. The Greeks called him Moiris, and believed that Lake Moiris, which they praised as the greatest wonder of hydraulic architecture in the world, also bore his name, for good reasons. Amenemhat III. was called the King of the Inundation, because it was in the direction of irrigation that he bestowed his energies.

On the supposition that Lake Moiris was an artificial structure, either wholly or in part, it has recently been proposed to use it again for the reception of the surplus waters of the overflow, and as a means of reclaiming the parts of the Delta now lying waste. Mr. Petrie

has said that the Fayûm basin could furnish much more arable land, if it were worth while to make more canals, especially high level canals, skirting around the sides.

This whole Fayûm Valley communicates, indirectly, with the Nile by means of a canal 207 miles long, parallel with the Nile. The waters of this canal are carried through a gorge in the Libyan chain, and after irrigating the Fayûm, the surplus evaporates from the Birket el-Kerûn. According to tradition this canal, called Bahr Youseef, owed its origin to Menes, and this seems to be indicated by the name it now bears—El-Menhi or Menhu. The name Bahr Youseef, or Bahr el-Yousefu, was given to it on account of repairs made upon it by Youseef Salah-e-deen, or Saladin. The ignorance of some Arab writers, and sadly too of some American writers, has attributed the work of this Eiyoobite Sultan to the patriarch Joseph, the son of Jacob. This Bahr Youseef runs from Assiût to the Fayûm, where it spreads out into a network of canals.

In early times the entire province was called "the Nome of Crocodilopolis"; also the "Arsinoitic nome." Here the crocodile-headed god Sebek received divine honors. I use such words reluctantly, for the old Egyptian conception of divine honors and our conception of divine honors bear not the slightest resemblance to each other. Sebek was sometimes Sebek-Ra, and formed a triad with Hathor and Khonsu. He was supposed to control the inundations. On his crocodile-head he wore the double feather with the sun's disk and the uraeus. He carried the sceptre in his

left hand, and the sign of immortal life in his right. He was usually painted green, we may be excused for thinking, in order to reflect that color on those who worshipped him. In spite of the honor he received in the Fayûm, from his supposed connection with the inundation, in other provinces this voracious beast was regarded as Typhonian. It is not necessary to say that this crocodile was never venerated in consequence of any amiable traits of character he was supposed to possess. Yet Strabo [xvii. p. 558] speaks of a crocodile, kept in the province of the Fayûm, so tame that priests could touch it. Herodotus, not to be outdone, says [ii. 69] that some crocodiles were so tame that they not only allowed themselves to be touched, but their ears were decked with earrings and their forefeet with bracelets. The office of curator of crocodiles, *i. e.*, the borer of crocodiles' ears, was no sinecure in those days.

Crocodiles were propagated in clear ponds, especially in Lake Moiris, where their number increased to such an extent that it was unsafe for one to wash his feet there, or even to walk near the water's edge.

It may be asked how an animal which devours men could be considered "sacred." The answer is that crocodiles were a defence to Egypt. Robbers from Arabia and from Libya, who would pillage the land, dared not swim the river; crocodiles, therefore, did police duty. Besides this, the fellaheen were taught to regard the crocodile as a symbol of pure water, fit for drinking and for irrigation; so long as this belief could be preserved, so long the government was certain that the canals and sluices would be kept in repair, be opened

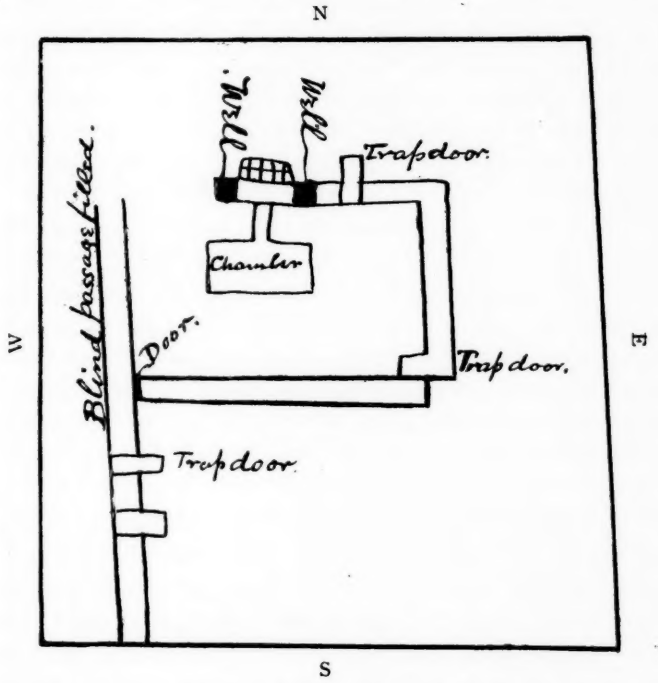
and closed at proper times, that, therefore, harvests would be abundant and taxes collectable. It was in this sense that the crocodile was "sacred"; and the god Sebek, with all his paraphernalia, was a religious artifice to make easy the solution of fiscal problems. Similar explanations would hold good for the pretended existence of some other so-called gods. The priests knew that they were no gods at all; but they were willing to dupe the ignorant and superstitious classes whenever they or the Pharaoh could thus reap any private advantage. We have little need for the theory that the "gods" of that highly intellectual, artistic people bore even the slightest resemblance, in origin or in import, to the totems of the wild red men of our Western forests. It is like comparing the conceptions of a Humboldt to those of an ourang-outang. The game played by these Fayûm priests was not without its retribution; for the devout worshippers of Osiris, the incarnate divinity, recognized, both in the god Sebek, and in his "sacred" animal, the crocodile, an emblem of Set, or Sutech, the Egyptian Satan; hence a most bitter feud between antagonistic sects; and it may be that persons now living have had occasion to observe to what extremes a sectarian quarrel, or even a difference in religious opinion, may lead. I have no doubt that we have struck here the very reason why the Labyrinth and Lake Moiris are never mentioned on the monuments of the XIIth (contemporary) dynasty, and why, in the list of the nomes of Egypt the district of the Fayûm was omitted, because not rendering supreme allegiance to Osiris.

THE PYRAMID OF HAWARA

was opened by Mr. Petrie in the winter of 1889–90. In a private letter, written after his memoir was in print, he says: "I tunnelled through the brick to the chamber from the north side; then I got masons to cut through the stone roof and so reached the inside. Then I crawled through the passages, which were nearly choked up, and had to slide through flat on the mud. Having found the entrance passage, I measured back to the outside and then set myself to work to open it from the top. Thus we have the original passage open and nearly cleared out.

"The arrangement is unlike that of any other pyramid known. The entrance to the pyramid is midway between the middle of the face and the corner, and on the south side, instead of being in the middle of the north side, as usual. The entrance slopes down into a chamber half full of water. There it appeared to end; but a gigantic trap door in the roof, weighing dozens of tons, admitted to a continuation at a higher level. A hole, forced in the masonry, now lets one through. Then a door of wood was to be seen on the east which led into what seemed to be a blank passage, while the continuation of the entrance line was all blocked up with solid stone. Cutting a way through that stone filling has given employment to some ancient people. Being filled it seemed to be important, and the passage, with the door, looked like a blind, whereas it was just the reverse. At the end of the east passage is a chamber with a deal of stone masonry in it, which was all a blind, since the exit was by another immense trap

door. Here the way is now forced; thence a passage goes north and turns; then another trap door is met. At last a chamber is reached which has been nearly filled with masonry. In the floor are two wells; but which the blind and which the true access to the funereal chamber it seems difficult to determine. Neither



of them has yielded to the spoilers, who forced a way through southward, and so reached the roof of the sepulchre. It is of quartzite sandstone. The robbers broke it away until a practicable hole was made and thus entered. We follow them. We find the great

polished sarcophagus of Amenemhat III. Between that and the east wall is a sarcophagus for his daughter, Ptah-nefru. The lids of both sarcophagi lie askew on them still.

"At the south ends are two boxes which held the funereal vases. These sarcophagi and boxes are quite plain except a projecting foot with the old panel ornament. The lids are rounded, with square sides. The only inscriptions are on the fragments of the alabaster vessels. There is the name of King Amenemhat III., and that of his daughter. The inner wooden coffins had been burnt, for we found charcoal in both sarcophagi.

"The most astounding thing is the chamber itself. It is nearly all one stone. Inside it is 22 feet 3½ inches by 7 feet 10½ inches, and 6 feet 2 inches high to the edge of the block. As the stone is about three feet thick, it must weigh about 180 tons. It is a block of hard brown quartzite sandstone, exquisitely cut, square and true into the corners, so that I never thought that it was not masonry until I looked for joints and found none."

Mr. Petrie has also effected an entrance into the pyramid of Illahûn. After descending forty feet down a well, a gently sloping passage led up to two chambers. The inner chamber was lined with red granite and was found to contain a sarcophagus from the same quarry, without lid or contents. Its sides are exquisitely flat and smooth, ground but not polished. Their exact similarity, of part to part, amounting to a mathematical equivalence, and their regularity are astonishing. Mr. Petrie adds: "It is the most brilliant

piece of mechanical work yet known in Egypt, or in any other country." In front of it stood a table of offerings.

We now pass to the famous Labyrinth, or the parliament house of Amenemhat III. Before we relate Mr. Petrie's story of its recent discovery, let us refer to its history. Herodotus says: "In order to bind themselves more closely together, it seemed good to the native princes to have one common monument. In pursuance of this resolution, they made the Labyrinth, which lies a little above Lake Moiris, in the neighborhood of the place called the city of Crocodiles [*i.e.*, Arsinoë, now called Medinet el-Fayûm]. I visited the place, and found it to surpass description; for if all the walls and other great works of the Greeks could be put together in one, they would not equal, either for labor or expense, this Labyrinth. * * * It has twelve courts, all of them roofed; with gates exactly opposite to one another; six looking to the north and six to the south. A single wall surrounds the entire building. There are two different sorts of chambers throughout, half under ground, half above ground, the latter built upon the former. The whole number of these chambers is 3000; fifteen hundred of each kind. The upper chambers I myself passed through and saw, and what I say concerning them is from my own observation. Of the underground chambers I can only speak from report; for the keepers of the buildings could not be induced to show them, since they contained the sepulchres of the kings who built the Labyrinth, and also those of the sacred crocodiles. Thus, it is from hearsay only that I can speak of the lower

chambers. The upper chambers, however, I saw with my own eyes, and found them to excel all other human productions; for, the passages through the houses and the varied windings of the paths across the courts excited in me infinite admiration as I passed from the courts into chambers, and from the chambers into colonnades, and from the colonnades into fresh houses, and again from these into courts unseen before. The roof was throughout of stone, and like the walls was covered all over with figures. Every court was surrounded with a colonnade which was built of white stones, exquisitely fitted together."

It is Pliny who says that this building was intended to be in strict imitation of the planetary system. Fifteen hundred chambers were connected with twelve courts, symbols of the twelve signs of the zodiac.

The best description of the Labyrinth is given by Strabo. He says:

"The Labyrinth is a building equal to the pyramids. It stands near the grave of the king who built it. After proceeding beyond the first entrance of the canal—about 30 or 40 stadia [*i. e.*, 4 or 5 Roman miles]—there is a table-shaped plain with a village and a large palace composed of as many courts as there were nomes in Egypt. An equal number of halls surrounded by pillars, and adjacent to one another, all in one line, form one building, like a long wall with the courts in front of it. The entrances into the courts are opposite to the wall. In front of the entrances there are long and numerous covered ways, with winding passages communicating with each other, so that no stranger could find his way into the courts or out of them without a

guide. The most surprising circumstance is that the roofs of these dwellings consist of a single stone-arch each; and that the covered ways, through their whole range, were roofed in the same manner, with single slabs of stone, of extraordinary size, without the intermixture of timber, or of any other material. On ascending the roof, which is not of great height—for it consists of only a single story—there may be seen a stone field, composed wholly of stones. Descending and looking into the halls, these may be seen in a line, supported by twenty-seven pillars, each pillar made of a single stone. The walls, also, are constructed of stones not inferior in size to these.

"At the *end* of this building, which occupies *more* than a stadium [610 feet], is a tomb, which is a quadrangular pyramid; each side of which is about four plethra [400 feet] in length and of equal height. The name of the person buried here is Imandes. They built, it is said, this number of courts because it was the custom for all the nomes to assemble there together, according to their rank, with their own priests and priestesses, for the purpose of performing sacrifices and making offerings to the gods, and of administering justice in matters of great importance. Each of the nomes was conducted to the court appointed for it."

Thus we see that during a part, at least, of the famous XIIth dynasty, Egypt had a representative government, as Strabo says, "for the administering of justice in matters of great importance." Egypt must have appeared to the world, at that time, as the centre of civilization; and of all progress in the province of intellectual, artistic and commercial activity. At the very

time when Abraham, and his retinue, were nomads of the desert, living in their wagons and tents, driving their flocks and herds before them, with no abiding place, no home and no desire for one; with no civil, political or educational institutions or influence, and no desire for any, the Egyptians, of the Fayûm at least, were holding deliberative assemblies in marble palaces, the grandest and most massive this world has yet seen, and enjoying a humane government, and a civilization in some respects still unsurpassed. Now how changed! While the fellaheen are engaged in the most menial employments, dwelling in tombs, or in huts reeking with filth, with no rights except the right to pay their enormous taxes to an inexorable government, a few rich bankers, living in England,—sons of Abraham according to the flesh,—have a mortgage for fabulous sums on everything in Egypt, and their representatives, belonging to a nation born but yesterday, dwell in Egyptian palaces and temples, and fare sumptuously every day. Truly there is nothing changeless, in all this universe, but God.

Until last winter (1889–1890) there has always been some doubt respecting the site of this Labyrinth. Lepsius placed it south of the Pyramid of Hawara; but Mariette-Bey found the ruins there nothing but Roman bricks, with only Latin and Greek inscriptions, not a bit of the white marble of which Herodotus speaks, and not a hieroglyph. He therefore concludes that the demolition of that immense structure could not be so complete, and that the site of the Labyrinth was yet to be found elsewhere. Linant de Bellefonds believed that the Labyrinth was situated eleven and a half miles from Hawara.

Mr. Whitehouse says that he "shook the foundations of Egyptian topography, in this region, by denying that the Labyrinth was at Hawara," and with unparalleled modesty adds that "the Ariadne of critical acumen and unstinted labor has furnished him with a clew, by which, when occasion presents, he can reopen to the world the 1500 subterranean chambers which Pliny pronounced *portentosissimum humani impendii opus.*" (See *The Critic*, 2d February, 1884.)

Strabo had said that the tomb of the builder of the Labyrinth was in the adjoining pyramid. Lepsius had found an inscription which said that Amenemhat III. was its builder. Mr. Petrie had found the sarcophagus of Amenemhat III. in the pyramid at Hawara. It was his next business to find the site of the Labyrinth itself. South of this pyramid he observed an area containing a dozen acres. Every pit he dug within this area brought him—ten or twelve feet below the surface—to a flat bed, with a pavement of clean flat-laid sand, or stone chips, rammed down and forming a sort of concrete. There appeared to him numerous evidences that this must be the site of some immense structure. There were thousands of tons of fragments of destroyed walls. This area extended a thousand feet in length, from north to south, and eight hundred feet in width; "a space large enough," says Mr. Petrie, "to contain all the temples of Karnac and of Luxor, on the east bank of the Nile, and the largest temple on the west bank besides." Could it be that he had found the long lost site of the famous Labyrinth? This is the very site which Lepsius identified fifty years ago. It answered exactly to the description given by Strabo. Nobody

questions it. All that remains of the great Egyptian Labyrinth, the model of the Labyrinth which Daedalus built at Crete, has been found. Not much remains! What the barbarians of the Roman period and the Moslem builders of mosques and dwellings did not want, the more recent builders of the railway have quarried. The foundations are gone and the plan of the great Labyrinth is lost beyond recovery—but the visionary American, who "could an' if he would" open to the astonished world its 1500 chambers, must now astonish the world in some other way.

Mr. Sayce begins his description of the Greek papyri found by Mr. Petrie in the Fayûm with this sentence: "It is not often that an explorer is so fortunate as to discover a prize like that which fell to the lot of Mr. Flinders Petrie last winter." Under the head of a once young and beautiful maiden was found a roll which contains the greater part of the second book of the Iliad. It belongs to the fifth century of our era, and, for its critical marks in the margin, and for many corrections in the hitherto received text, is of great value. The skull of this second Hypatia, which was pillowed on such a priceless treasure, together with her black tresses, are now in the Bodleian Library at Oxford. Besides this, Mr. Petrie found the floating sand, in the cemetery at Hawara, full of shreds of papyri, which have been carefully preserved, unfolded and pieced together. They seemed to have formed the contents of the office of some public scribe. They contain copies of deeds and other legal documents, and extend from the Ptolemaic age almost to the Arab invasion. They are dated in the reigns of Tiberius, of Vespasian and of Antoninus.

One official stamp, of the Ptolemaic age, is an authentic example of printing from wooden types. It shows how near the Egyptians came to the art of printing, two thousand years ago! Indeed, they had invented the art; they only failed in its extended application!

Mr. Petrie found, in all, four hundred and eighty papyri besides numerous fragments not yet classified. They are in hieratic, demotic and Coptic, as well as in Greek. They give us much information about the domestic and social customs in the Fayûm, the cost of living in a frugal family, the price paid, by the cook or steward, for bread, meat, eggs, beans, lentils, oil and figs; and how he sometimes tried to cheat his master by a false entry, or a wrong addition, just as cooks and stewards in similar cases do now; only then there was no Canada to which they could flee. These papyri also show how coins became dirty, (what would they have said of some of our paper currency?) how payments were sometimes made in coin, sometimes in truck, how money lenders and exchangers abounded, and were experts in the very tricks of knavery of which men, now living, are not ignorant! Would that we could trace, in 4000 years, a greater reform in the morals of trade!

Large quantities of Greek papyri have found their way, recently, into the museums of Europe. In Vienna is a valuable text of the first gospel, written in the third century; also a series of fragments containing parts of the book of Genesis, the Psalms, Isaiah and all four of the gospels, dating from the fourth to the sixth century. The text of the gospels has Greek on one side and Coptic on the other.

In the department of ecclesiastical and Roman history these Fayûm texts are of striking importance. They contain with scarcely a break a complete series of imperial edicts from Domitian to the abandonment of Egypt by the Romans in the VIIth century. The first edict of Domitian is dated in the year 94 A.D. Think of it! Five centuries of edicts embracing the reigns of pagan and of Christian emperors! These documents must be nothing less than the remains of some provincial registry, perhaps the Astor Library of the Fayûm. One record—a Coptic document—relates the curses pronounced by a heathen mother on her son who had become a Christian. It intimates that the son, like many a martyr in those days, not content to enjoy "a fellowship with the saints," had pronounced curses before the altar of some Egyptian divinity, and threatened their gods and temples.

Some of the Greek classical papyri are written with great care. Prof. Mahaffy has been studying them for months, and he says that "they belong to the third century B.C., certainly not later that that," and he adds, "such astounding and unexpected antiquity, in a Greek manuscript, takes one's breath away."

While speaking of recently discovered papyri, I must not omit those which were brought to light, only last year, at Deir el-Bahari, not far from the place where the royal mummies were found in 1881. I have a description of the scene from one who stood near the mouth of the well, fifty feet deep, and saw 163 Arabs drawn up the well by ropes, each Arab bearing a mummy on his back. As the mummies seem to have been swapping sarcophagi with each other, and are therefore

somewhat mixed, it is not easy to estimate the exact value of this new "find." Between sixty and seventy papyri have been found, and we know not how many more may be secreted in the mummy cases.

Mr. Petrie, or Mr. Newberry, his assistant, has examined ninety-five species of vegetable remains from the cemetery of Hawara. Taking into consideration all the plant remains of the ancient Egyptians, he concludes that those plants which have come in contact with man have become changed, up to a certain point; while the wild plants, that now surround us, grow in the same forms as they did 3000 years ago, and exhibit not the smallest change. Multitudes of these seeds have been planted, but one and all alike have refused to germinate. There is not, and there never was, the least foundation for the story that a seed which a mummy held in his hand for thousands of years sprouted, budded and blossomed. It never did.

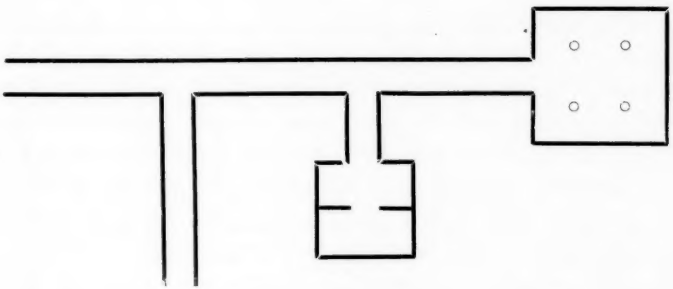
In 1887, as some fellaheen were engaged in the pursuit of relics at El-Amarna, in Upper Egypt, among the ruins of the temporary residence of Amenhotep IV., more than 200 tablets, covered with cuneiform inscriptions, were found. They prove to be a part of a correspondence between kings and other officials of Asia, and two Pharaohs, belonging to the XVIIIth dynasty. Among numerous subjects discussed they contain accounts of intrigues between the Assyrian and Egyptian courts, with exchanges of presents and warnings. The chief Assyrian correspondent speaks of a treaty between Assur-na-din-ahi and Amenhotep III., and calls himself the father-in-law of that Pharaoh. The leading topic is the marriage of his daughter to the Egyptian king.

Such towns as Byblos, Samaria, Megiddo, Akka and Askelon, are represented as owing allegiance to Egypt. The letters were written by officers or vassals, who were governing for Pharaoh his Asiatic provinces. On one tablet Prof. Sayce has found a letter to Amenhotep III. from a place called Urusalim (the Hebrew for Jerusalem). From this Prof. Sayce has no doubt that fifteen centuries before our era "the city of the great king" was garrisoned by Egyptian soldiers. These tablets are of the deepest interest and form the most unexpected discovery of modern times.

East of the ancient town of El-Amarna are two ravines in the amphitheatre of cliffs; the northern one is called *Darb-el-Hanz wari.* If this is followed for a distance of three miles or more from its mouth, we enter a small valley which branches from the left-hand side of the main ravine. Towards the head of this, on the left-hand side, is the tomb of the Pharaoh who tried to dethrone the god of Thebes. It is, like the "tombs of the kings" at Thebes, a subterranean passage cut in the rock, and sloping downwards at an acute angle to a distance of more than a hundred metres. After entering the spacious passage to the tomb, we pass, on the right, a long passage, never finished, perhaps intended for the queen. Soon afterwards we come to a chamber, also on the right, which serves as an ante-chamber to another within. The walls of both chambers have been covered with stucco and embellished with hieroglyphics and sculptures.

Here are figures of prisoners from Ethiopia and Syria; there the solar disk; here female mourners who weep and throw dirt on their heads. The inscriptions

inform us that the two chambers were the burial place of Khu-en-aten's daughter, ***Aten-mert,*** who must, therefore, have died before her father. Khu-en-aten himself was buried in a large square columnal hall at the extreme end of the passage. Fragments of his granite sarcophagus have been found there, and pieces of the exquisitely fine mummy cloth in which his body was wrapped, beside *ushabtis* bearing his name. The only



finished portion of the tomb is the chamber in which his daughter was buried. Elsewhere the tomb is in the same condition as the tombs of his adherents. The walls have never been covered with stucco, much less painted or sculptured, and even the columns of the magnificent hall in which his sarcophagus was placed remain roughhewn. It is clear that the king died suddenly and was buried in haste, probably on the morning of a revolution. His followers may have made a stand against his enemies for a few months, but it is difficult to believe that they could have done so for a much longer time. It is, indeed, possible that before his body was properly entombed his enemies broke into

his last resting-place, destroyed his sarcophagus, tore the wrappings of his mummy to shreds, and effaced the name and image of his god wherever it had been engraved on the wall. Very shortly after the Pharaoh's death his city must have been destroyed, never to be inhabited again.

[See a letter of Prof. Sayce in the *Academy* for February 27th, 1892.]

BUBASTIS.

Herodotus informs us that at one time capital punishment was abolished in Egypt, and all criminals, during a period proportionate to the enormity of their offences, were set to work raising the ground in the neighborhood of the city to which each one belonged. From this we must infer that Bubastis did not enjoy a very high reputation, for the ground around it was raised higher than that of any other town. Its most ancient temple was left down in a hollow; the roof and *pylae* below the foundations of all the dwellings of the town. This temple was originally dedicated to Bast or Pasht; though later, and especially in the time of Ramses II, altars were erected to Amon, Set, Ptah and Ra. Herodotus said of it: "Other temples may be grander, and may have cost more in the building, but there is none so pleasant to the eye as that of Bubastis." He follows this statement with a minute description of the famous structure. It was built, he says, of the finest red granite

In 1889 M. Naville excavated the ruins of this temple. They are ruins with an emphasis. The destruction is complete. Who the wanton spoiler was we shall never know. The temples of Lower Egypt were of

that style of construction which fitted them to be used as fortresses, and we may suppose that their destruction was accomplished in times of war. We know that Bubastis was besieged by the Persians, and that it fell in the time of Phocas. Besides, it was situated in the direct line which all invaders, from the east, would take, whether they were Syrians, or, the Shasu ever hovering around the eastern boundary; or Hittites from Asia Minor, or Mesopotamians, or Persians. Bubastis was therefore a strategic point which every ambitious general coveted.

Up to the present day no monuments or inscriptions have been found in any part of Egypt so old as the IId dynasty. I say this, not in forgetfulness of the necklace, bearing the name of King Menes, of the Ist dynasty, belonging to the Abbott collection, and now in the rooms of the Historical Society in this city. M. Naville found at Bubastis monuments dating back to the IVth dynasty. The names of Khufu and Khefra, builders of the two largest pyramids of Gizeh, are among them. This is the first time any mention of these two kings has been found on a contemporaneous edifice, not a tomb, north of Memphis. They were more extensive builders than had been previously supposed. The name of Pepi, of the VIth dynasty, was twice found at Bubastis. So many evidences of the Hyksos kings appeared there that the town may have been a rival of Zoan. Two of the finest statues discovered there bear the Hyksos features—high, strongly marked cheek bones, cheeks hollow, mouth projecting and stout lips with fleshy protuberances at the corners. Though clearly belonging to the XIIIth or XIVth

dynasty, Ramses II. had put on each of them his own name and had hammered off the name of their proper owner. Among the discoveries made by M. Naville are the names of twenty-five kings, from Khufu to Ptolemy Epiphanes; giving us glimpses of the history of Egypt for 4000 years. He also found at Bubastis the name of Ian-Ra, or Ra-ian, a king previously unknown. So frequently does the name of Ramses II. occur there, and so great a favorite of his was this city, it now appears quite possible that Bubastis, not Zoan, was his residence and that of his son Menephtah, and that "the wonders wrought by Moses and Aaron in the field of Zoan," and their interviews with Pharaoh were in Bubastis, and not in Zoan.

On February 6th, 1889, as Mr. Charles Edwin Wilbour, a native of Little Compton, R. I., was walking along the south-eastern part of the little island of Seheyl, well up from the water, in full view of the Isle of Philae, he discovered one of the most important texts found in these last years. It covers the side of a rounded block of granite eight or nine feet high. In the inscription, a message is said to have been received by the King of Nubia, and of the cities of the South at his residence at Elephantine, from King Te-sor, in the eighteenth year of his reign, describing the terrible famine in Egypt, in consequence of the failure of the Nile during seven consecutive years; and asking for authentic information about the rising of the Nile, and the gods who were taking part in the inundation. The governor supplied the desired information, and gave ample statistics with regard to the nature of the animal, vegetable and mineral wealth of the country.

The king, on receiving this report, made an offering to the gods and goddesses of Elephantine, and was rewarded by night with a vision of the great god Khnum, who complained that, from time immemorial, stones were ready but no man turned them to use for building temples to the gods, or for repairing those that were falling into ruin. The god promised that henceforth the Nile should issue forth, and that not a year should fail; that the famine should cease; that corn should grow in plenty, according to the heart's desire; even more plentifully than ever before. The king awoke; his courage revived, and he issued a decree, endowing the great god of the cataracts with the arable lands on the right and left banks of the Nile, about two hundred acres in all, with dues to be paid by the inhabitants of the district "from the produce of their barns, and of whatsoever the fisherman catcheth, or the hunter doth entrap, or the fowler acquire; of all these," says the king, "I offer thee a tenth part. So of all the gold, ivory, ebony, and all other articles of commerce. Stone cutters, workers in metals, traders in rare stones, all shall pay the same tithe." This inscription was engraved on the side of an immovable boulder, in a conspicuous place. Although it professes to be the record of a decree of Te-sor, a king of the IIId dynasty, yet the style betrays a later age, perhaps as late as the Roman period. The allusion to the "seven years' failure of the Nile" has given to it the name "The Tablet of the Seven Years of Famine." The whole inscription has been published by Dr. Brugsch, with an introduction, translation and an explanation of everything that needs explaining. Dr.

Brugsch regards the whole thing as a "pious fraud," drawn up for the express purpose of furnishing an ancient precedent for a modern tax of ten per cent. The argument which some Greek or Roman governor used was this: If the great god Khnum could demand the revenue of one tenth of every man's income, why not I? Yet the tablet is none the less instructive, showing as it does that there was a tradition in Egypt that, at some remote age, there had been severe distress in consequence of a famine which had lasted seven years. By no process of reasoning can the allusion be identified with the biblical seven years of famine in the time of the patriarch Joseph.

This lecture has given a few glimpses of the high civilization which Egypt once attained. The contrasts of Egypt past and present are most striking. Now she is nothing but a decaying carcass over which envious vultures are hovering, and one is rapidly devouring. The period since the ruthless bombardment of innocent, defenceless Alexandria has been the one most destructive to the monumental records of Egyptian history which the world has ever seen. It has been seriously proposed, of late, to build a reservoir above the First Cataract, which will submerge the Isle of Philae!* So little does the present government care what shall become of those unrivalled structures, if only money enough to pay the coupons of Ismail Pasha's bonds can be filched from the miserable fellaheen.

The outlook for Egypt is not hopeful; yet the cloud may have a silver lining, though we see it not. In

* See *Bosphore Égyptien*, Le Caire, le 2 Mai, 1891.

ancient fable it was the tear of Isis, weeping for her suffering children, that caused the Nile to rise. There is still a Moslem belief that an angel brings a drop of water from Paradise every year, and that causes the inundation. All this is only a poetic, mythological way of expressing the belief that the Nile is fed by the waters of heaven falling on the Abyssinian mountains. However unworthy of preservation the present mongrel race of Egyptians may seem to be, no sparrow falls unnoticed, and a heaven of love still broods over that fairy land, and in its own time and method may bring light out of seeming darkness, and make even a moral desert as fragrant as the rose that buds and blossoms in queenly beauty. A thousand events of this life are beyond our control, and all we can do is to "let patience have its perfect work." That was a profound, inspired precept of Epictetus: "Seek not to have things happen as you choose them, but rather choose them to happen as they do; and so shall you live prosperously."

EXPLORATIONS IN THE BENI PROVINCE.

BY

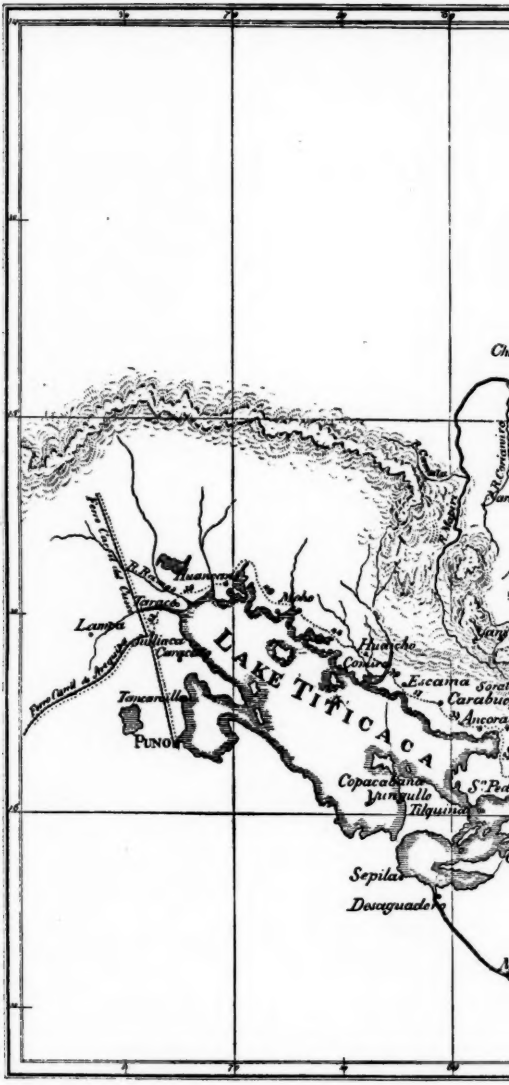
BARON H. ARNOUS DE RIVIÈRE.

I first went to Bolivia in the year 1866 to take possession, after discovery, of the guano deposits of Mexillones and, in La Paz, I met the Count de la Ribbete, who was then at the head of the Mineral School of Bolivia; and, having in his possession all the documents and records, as well of the Indians as of the Spaniards, he told me about the legendary treasures and the gold carrying streams forming the river Beni, insisting more particularly on the richness of the river Tipuani.

The last of the modern workers of these rich deposits had been Mr. Villamil and Mr. Saballa. Both had extracted large amounts of gold, but at their death the works ceased. The Indians, finding no more employment, and having no means of living, abandoned that region, which once more became a desert.

I had then no time to undertake this exploration; but determined to do it as soon as circumstances allowed.

Things remained in that state for twenty years, and I returned to La Paz in 1886. There I met a descendant of Villamil who represented the rights of his family and claimed possession of the old Villamil gold diggings

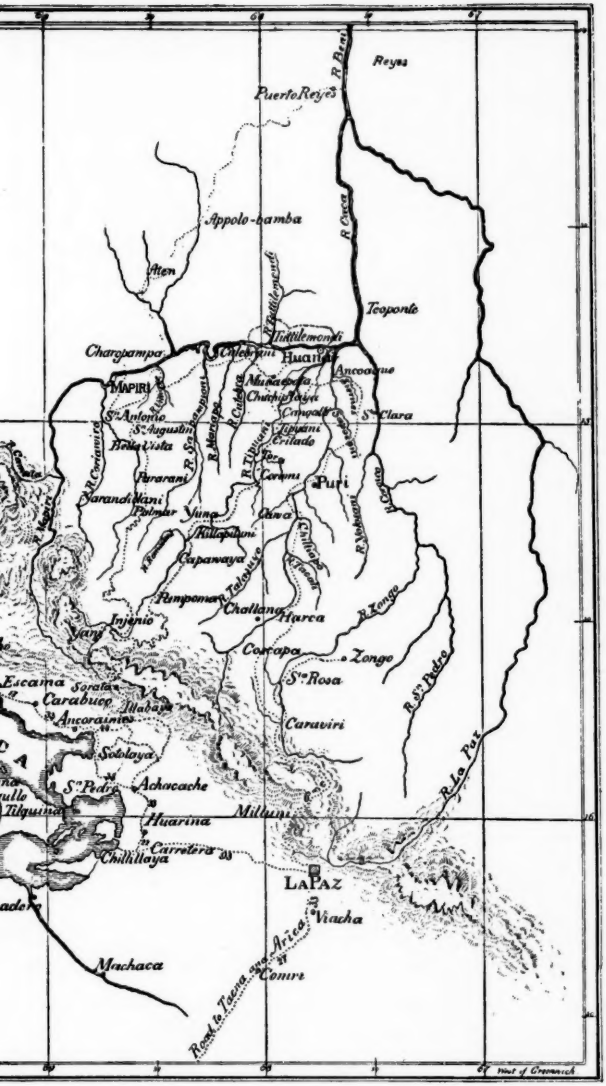


REJION AURIFERA

EXPLORATIONS OF YEARS

DISCOVERY OF THE GOLD MINE TUTTILEN

The Distances are in kilomet



RIFERA DEL RIO MAPIRI.

NS OF YEARS 1887, 1888, 1889, 1890.

NE TUTTILEMONDI BY BARON H. ARNOUS DE RIVIÈRE.

are in kilometres: 4 kilometres=2½ miles.

on the Tipuani. A Mr. Leclerc, a poor old dentist, also claimed possession of Cuebaplaya, Chuchiplaya and Churumani on the same river.

A German company, formed by shop-keepers in Sorata, was in nominal possession of Isquisivi, located in front of Chuchiplaya. But all these people, being thoroughly ignorant and incompetent, lost their small capital, and abandoned the work.

Still, the legends concerning the fabulous wealth of the Beni were confirmed by these men; and some thousand ounces of gold came from time to time to La Paz, brought in by peddlers from Sorata, who traded with the Lecco Indians.

The peddlers reported that the roads were mere Indian paths through the virgin forest, and that the rivers were not navigable, so that when I declared my intention of exploring personally all the old placers, and tracing a provisional map of the head waters of the Beni, every one in La Paz discouraged me.

The *alta planicie*, an immense plain extending from the lake Titicaca to the lake of Poopó, south of Oruro, is closed on the east by the majestic glaciers of the Andes, forming an uninterrupted barrier of ice. This is the core of the Andes. Three enormous peaks detach themselves from the chain. They are:

The Illampu, or Sorata, to the north, 24,000 feet elevation.

The Huama-Potosí in the centre, 23,000 feet elevation.

The Illimani to the south, 23,500 feet elevation.

After the loftiest peaks of the Himalayas, these are the highest mountains in the world.

The problem before me was, to find the best, the shortest and the cheapest route across that icy barrier, and into the Eldorado, on the east.

To be sure, there was a passage from Sorata to the east; a miserable mule path, traced in the most stupid and erratic way; but even that route only went as far as the cinchona plantations and ended at the village of Mapiri on the Mapiri river. The traveller had then to take his chance on a *balsa*, or raft, and float down the stream, in the midst of dangerous rapids. As for getting up stream, that was still more difficult, long, and perilous.

There must be another route; and I determined to find it. I felt convinced that I should come across the great gold placers of the Incas and of the Spaniards, and that the desert would be made once more to yield its treasure.

I had brought from England a drilling machine, and an engineer—Mr. N. C. Unfortunately, this gentleman did not fulfil my expectations and I had to send him home. I then undertook to explore personally all the different streams having their head waters in the eastern slope of the Andes, and contributing to form, by their junction, the Beni river. At the same time I traced a provisional map of these streams and of the gaps in the Andes, and kept a strict diary of all my observations.

Triangulation being impossible through the wild forest, the streams being deeply encased, and the horizon very limited, while I was obliged to cut every foot of the road with axe and cutlass, I limited my work to tracing the course of the rivers with compass and chain,

using the barometer for altitudes. I do not pretend that my map of the Beni is geographically exact; but it is the only reliable one in existence.

Humboldt made no map of the great desert which he calls Misiones, and the fathers, Jesuit and Franciscan, have left none. Raimondi and Paz-Soldan, the two Peruvian geographers, penetrated no farther than the Purus river, and the province of Carabaya, and when we examine the pretended geographical maps of Bolivia, we find them to be without exception absolutely incorrect. We can only be astonished that the statesmen of this great country should have abandoned, up to the present time, its richest province. This abandonment is so complete that we may say there is no authority existing in these regions, and no tie between its inhabitants and the rest of the nation.

If you speak of Bolivia to a Lecco Indian or to a man from the Beni, the Madre de Dios, the Aten, or the Challana, they will tell you that they do not recognize a government which does nothing for them except to collect a personal contribution; and yet that region begins at only seventy miles' distance from the capital, and is quite worthy of all the attention that can be bestowed upon it. All the rivers carry gold—all the lands are fertile beyond imagination. Its forests, now unexplored and unworked, furnish the most beautiful specimens of wood, and might at least give fuel to La Paz, the capital of the country, where the only fuel is dried animal manure.

A road to place the Beni in communication with La Paz would consolidate industrial enterprise, agriculture and commerce, which are now almost impossible for

want of means of transportation for the people and their machines and tools.

The study of these routes was the principal object of my explorations.

Some time ago the government named a commission to make a report on the practicability of the road. It was pronounced feasible ; but as this commission limited itself to following the Indian path, without any serious study of a project, and without having even traced a map to form the basis of such a study, I could make no use of their pretended exploration. I had, therefore, to construct provisional maps sufficiently accurate to lay down a projected route.

Two most important points are now determined :

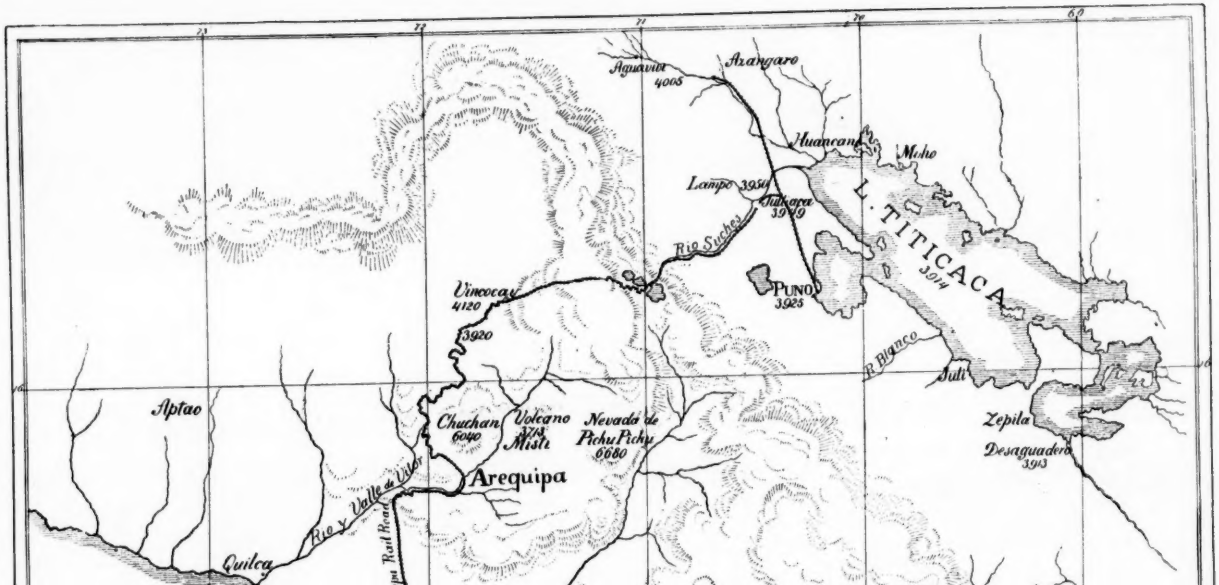
First : The execution of the road is easy, and its cost will be insignificant, when compared to the results it will give.

Second : That none of the existing paths can be used. The road must be cut across the forest, following as nearly as possible the course of the river, having thus a natural grade and avoiding costly constructions.

STUDY OF THE ROUTES EXISTING.

There are at present four routes from La Paz to the Beni.

First : The route by Sorata, Yani, Tola Pampa, Palmar, Mapiri and Huanai. This route is 560 kilometres (348 miles) in length, of which 216 (134 miles) are by water, during the months when the navigation of the Mapiri is possible. This road exists ; but it has been so absurdly traced and so badly made and is so much neglected, though the tolls are heavy, that it can


Aguaviri
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4120
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PUNO
3925
R. Bigaco
Juli
Zepita
Desaguadero
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Alpaa
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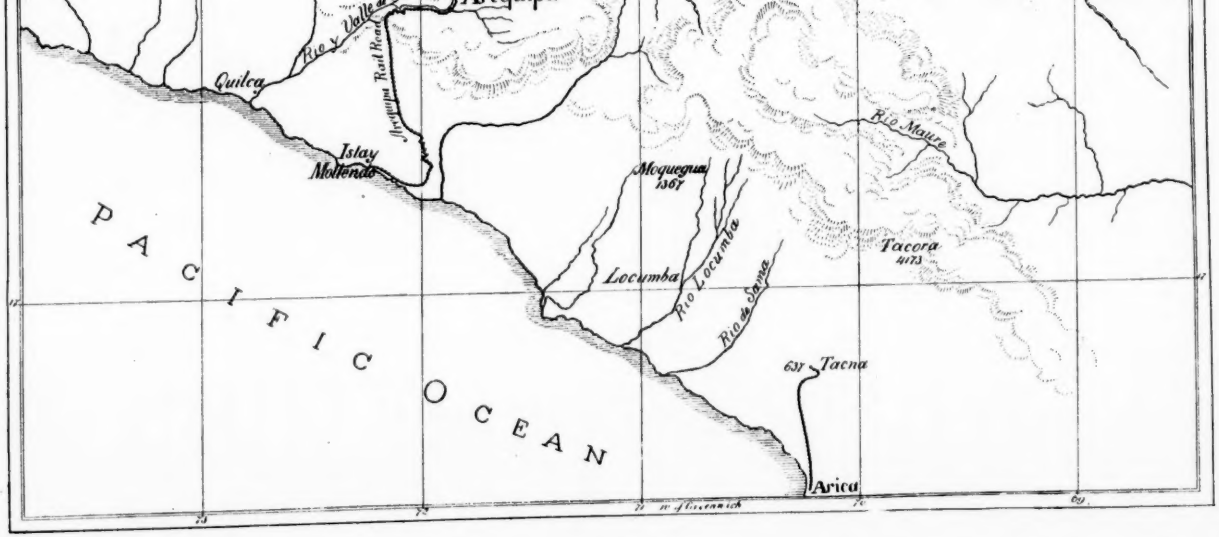

MAP

SHOWING THE APPROACHES TO LAKE TITICACA FROM THE OCEAN.

The altitudes are in metres: 32 metres=105 feet.

only be travelled with extreme discomfort and at great risk. Nevertheless, cargo mules are constantly going up and down to the calisaya plantations of Mapiri.

Second : The route by Coroico, with a length of 496 kilometres (308 miles), of which 132 (82 miles) are on a very decent cart-road. But the 364 (226 miles) remaining must be done by water; and although navigation down stream is almost always practicable, it is not the same with the upward voyage, which is perilous, uncertain and very slow. The canalization of the Coroico so as to make it navigable would necessitate a very large expense.

Third : The route by Sorata, Kilapuni and Tipuani, like the preceding, is 496 kilometres (308 miles) long, but the unnecessary deviation to Sorata lengthens it by 165 kilometres. It has, moreover, like the road by Mapiri and Palmar, the great disadvantage that it is useless to the valleys of the Challana, the Songo and the Yolozani, which are far more fertile, rich and interesting than the Tipuani district. As it is, it is passable for mules with light loads, which must be removed in the perilous places. It would be easy to make this road serviceable; it would cost less than the one by Mapiri, and would be free of toll-gate.

Fourth : There exists a wholly impracticable road, a mere Indian path; and yet it leads in the only well-chosen direction. This is the road that I have proposed to study more thoroughly, taking La Paz as the basis for operation.

The commission above referred to, although it was right in selecting the Challana valley, made serious mistakes in the details, probably for want of time and

means to do the work in the right way. The surveyors laid down a very difficult line, abandoning completely the valleys of the Songo and the Yolozani. The course of the latter is not even mentioned; and the great mistake they made, in respect to distances, proves that they were content with following the course of the Challana.

I suppose that the line traced by the commission through Penas and the northern part of Huama-Potosí has for its object to shorten the distance between lake Titicaca and the town of Sorata. This is an error. The time is not remote when La Paz will be in railway communication with the Pacific. The Northern Railroad by Arequipa and Puno, continued to La Paz by Sepita and Desaguadero, will do away with the insignificant navigation of the lake. It will diminish the rate of freight, now excessively high, and there will be no change of cars between the Pacific port of Mollendo and the capital of Bolivia.

Three railroads will eventually put La Paz in communication with the Pacific Ocean.

The northern, by Mollendo, Arequipa and Puno, will be extended along the western shore of lake Titicaca, passing by Sepita and Desaguadero.

The central one, by Arica and Tacna, will be extended by Tacora, the Maori river, San Andres and Viacha.

The southern, by Antofagasta, passing through the nitrate district, the Caracoles and Huanchaca silver mines, and Oruro, is now carried as far as Oruro, and will be completed to La Paz by the end of this year.

La Paz must become the commercial centre for the Beni trade. Sorata, with its very small commerce and industry, is in the hands of a few strangers who have

done nothing to promote the general prosperity; and when the agricultural population communicates directly with La Paz, and the Pacific, it will not regret the loss of these little shops and their ruinous prices.

For the present, until the railroads are completed to La Paz, and the government undertakes the construction of the Challana road, which I have advocated, the easiest, shortest and cheapest way is the following:

The Arequipa railroad strikes lake Titicaca at a place called Juliaca, where it branches, on the south to Puno, and on the north toward Cuzco, the great capital of the Indian kings in Peru.

Juliaca is a very thriving little village, and the railroad to Cuzco, begun by Mr. Meiggs, is now being completed by Mr. Morris, another American engineer.

From Juliaca to the Mapiri river there is a very good mule path on level ground. This might be very easily transformed into a cart-road, along the northern shore of the lake, passing by Taraco, Huancané, and Moho, to Huaichu, a distance from Juliaca of 162 kilometres (101 miles). Huaichu is on the frontier of Peru and Bolivia, and is situated not far from the Mapiri river, the course of which could be followed down to its junction with the Camata, at which point the Mapiri begins to be navigable. The advantages of this route are that it does away with the perilous crossing of the Andes at Sorata, and saves nearly 150 kilometres (93 miles) in distance.

There is no difficulty in finding labor on the western side of the Andes, and on the eastern side the laboring population would very soon increase if there was steady employment. Other conditions are favorable.

The climate of the Beni, which lies between 14° and 16° latitude south, is tropical, with a rainy and a dry season; the soil is of extraordinary fertility, and there is every variety of animal, wild and domestic. Food is abundant. An ox costs in Reyes from four to five dollars; a sheep can be bought in Huanai for $1.20; a good mule costs $60, and a llama from one to three dollars. Pigs, and poultry of every description are abundant and cheap. There are two crops of rice and corn in the year; the banana gives fruit eight months after planting; the sugar cane grows fifteen feet high, and every kind of fruit and vegetable can be raised. Cotton and gum grow wild.

The predominating Indian race is that of the Leccos. They are white, tall, well formed and lazy. The men shoot, fish and man the rafts on the river, and cultivate just enough corn, rice and potatoes to last them for the season. The women cook, make clothes, spin the cotton, dye it and weave some very clever fabrics. Their language is entirely different from the Quichua, the Aymará or the Spanish.

They all wash gold, and the women are particularly skilful in the management of the *batea*, or miner's wooden pan.

The gold gravel extends over such a vast territory and is sometimes found in such enormous deposits, that it is practically impossible to estimate the amount of gold that could be obtained by hydraulic process. The metal is in a very fine laminated state, and gold gravel is easily disintegrated. Very few bowlders of large size are found, and there is any amount of dump and water head. Timber for building purposes abounds.

Much has been said of the unhealthiness of the Beni province, and the death of many of my followers seems to confirm the statement. It is nevertheless untrue.

In some of the old works, especially those on the Tipuani river, the pits and deposits made to accumulate water, not having been cleaned or drained for many years, have become pestilential swamps, filled with stagnant water and vegetable matter in a state of decomposition. The Indians avoid the neighborhood of such swamps and live on the higher places. When I discovered Tuttilemondi, I found a large swamp of the kind on top of a gold gravel; but I drained it to the bottom by a trench, and planted sugar cane and banana trees, and the place became perfectly healthy.

Another cause of sickness is the intemperance and the carelessness of the immigrants. The climate being warm, they are thirsty, and drink the water of the main rivers or of the little streams that wash the forests, in which dead leaves and dead insects are constantly decomposing. Such waters contain animalculæ and produce a swelling of the stomach very similar to dropsy. At other times the men drink to excess of rum and also eat fruit immoderately, with the natural consequences; but I believe that this region is as healthy as any tropical climate can be, and will lose its malarious effect as soon as the forests are partially cleared for agriculture or mining purposes, and some little drainage is made in the swampy grounds.

I have made five different explorations of the Beni in five years, sojourning each year, and at different seasons, for months at a time. In one expedition, I had with me a daughter only sixteen years of age. In the year

1889 the wife and daughter of Mr. Martindale, the engineer, remained for eight months in Tuttilemondi, the young lady being only fourteen years of age, and we all liked the country and agreed that it would be a most charming place to live in, with a comfortable house, such as we had, and the necessaries of life; and these are within reach.

There is, of course, a period of acclimatization for those who are new to the tropics. The insects are, at first, very troublesome and their bite often produces inflammation, but with a little patience, a real inoculation takes place, and the bites of mosquitoes and ants are no more to be dreaded.

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AN EXPEDITION TO THE NORTHERN MAGNETIC POLE.

A DISCUSSION BEFORE THE AMERICAN GEOGRAPHICAL SOCIETY, MAY 2, 1892.

The meeting was opened at 8.15 P.M.

Chief Justice Daly, President of the Society, said: The meeting this evening is to be devoted exclusively to the consideration of a proposed expedition for the exploration of the region immediately around the North Magnetic Pole, a subject which it is especially appropriate for a geographical society to consider, as the investigation and increase of our knowledge of terrestrial magnetism is one of the objects for which such societies have been founded. Such an expedition has, at least, this to recommend it, that the North Magnetic Pole can be reached and the portion of the Arctic immediately about it, or in its vicinity, can be traversed, whereas the Southern Magnetic Pole lies in an ice-bound region which man has not penetrated and perhaps never will penetrate.

The idea of this expedition was suggested two years ago by Colonel Gilder, in respect to whom it is appropriate that I should say a few words. Colonel Gilder is a distinguished officer of our war for the preservation of the Union, who served throughout the whole of that war in three army corps. A few years after his return, that is, in 1879, he volunteered to go in the expedition sent out by this Society in that year, called the Franklin Search Expedition, to discover the diary and papers of Captain Franklin, which, it was supposed from informa-

tion which the Society had received, might possibly be discovered in a certain part of the Arctic. Though the expedition did not accomplish the object for which it was sent out, it was at least successful in the large amount of accurate information that was obtained respecting the region traversed by its members. During this expedition Colonel Gilder performed the longest sledge journey upon record.

He has the advantage, moreover, of having been in sight of the locality where Sir James Ross, in 1831, found the North Magnetic Pole; that is to say, he was on that extreme portion of King William's Land known as Cape Felix, and in front of him, or east, say about twenty miles distant, was Cape Adelaide, where, as I have said, the Pole was discovered by Sir James Ross sixty-one years ago. Afterward, in 1881, he went as a volunteer, in the "Rodgers," a vessel fitted out by our Government to search for the "Jeannette" and the lamented Captain De Long, and in that expedition he performed a remarkable journey over the whole of Siberia, occupying a period of five months and embracing a journey of 6000 miles, which he made alone, with no aid except that of the natives. I mention these instances because he is a most appropriate person, from his experience as an explorer, to lead an expedition for the survey of the region immediately around the North Magnetic Pole, the scientific part of which survey will be the work of the specialists that may go in the expedition.

I shall not, by any remarks of my own, anticipate what will be more appropriately said by the distinguished gentlemen that are to speak to-night, who are magnetists and authorities upon all questions of terrestrial

magnetism, in respect to the utility and value of such an exploration. It is sufficient to say that we owe to the Chinese, I think about eleven hundred years before the beginning of our era, the discovery of the polarity of the needle, and that it is to the introduction of the compass in Europe, through that discovery, that certain portions of the globe were reached by water which never would have been reached without the aid of that instrument. It is to its aid that we owe the crossing of the Atlantic, then called the Sea of Darkness, by Columbus, and the discovery of America. Everything, therefore, which adds to what we know of the variation of the compass and the cause of it; in fact everything that increases our knowledge of the phenomenon that we call terrestrial magnetism is of the greatest interest to mankind. How far the proposed expedition will or may lead to information of that nature you will hear from the gentlemen who are now to address you.

I regret that two of the gentlemen that we expected here to-night will not be present. Professor Mendenhall is unable to come, but sends us a letter which I will read to you, and also one from Professor Marsh, President of the Academy of Sciences at Washington; both of whom are in favor of sending out an expedition of this nature.

The letter I read is addressed to Colonel Gilder by Mr. Mendenhall.

UNITED STATES COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., April 30, 1892.

MR. W. H. GILDER, 40 Wall St., New York City.

Dear Sir: I regret very much that official duties which cannot be postponed will prevent my being

present at the meeting on Monday night, as I had hoped to be up to a recent hour. I am much interested, both personally and officially, in the subject which will engage the attention of the Geographical Society on that occasion, and I would have been glad to aid in any way the development of a plan for accomplishing what all well-informed people must regard as an important work. In order that Judge Daly (to whom you may show this letter if you think it desirable), may understand the relation of the Coast and Geodetic Survey to the proposed scheme up to the present time, I will briefly recount events bearing upon it during the past few years.

About two years ago you called upon me and suggested the desirability of an expedition to the region of the North Magnetic Pole. You asked what assistance, if any, in the way of observers and instruments, could be furnished by the Survey, and expressed your willingness to take charge of such an expedition. You also stated that you believed that a sufficient sum of money to defray the expenses of such an expedition could be obtained by voluntary contributions. In reply I declared my belief in the importance and desirability of such an investigation, and stated that under certain conditions the Coast and Geodetic Survey might be able to detail a skilled officer for conducting the magnetic survey, provided his expenses could be paid. I brought you into conference with Mr. Schott, the first authority in the country on this subject, and also suggested that the subject seemed to me of sufficient importance to justify asking the advice and coöperation of the National Academy of Sciences. At my request

the Secretary of the Treasury sent a communication to the President of the Academy, asking that body to advise the Government as to the best methods of securing the desired end. A committee was appointed by the President of the Academy, and the subject has been under consideration by this committee for a year or more.

In the meantime you have assured me that you have renewed assurances of contributions, and excellent prospects of securing an ample fund for carrying out the exploration in a manner such as to insure success.

The information to be gained by such an expedition is important for several reasons. The determination of the location of the Magnetic Pole would be of great service in the development of the general laws of terrestrial magnetism, a subject of which we, as yet, know comparatively little, notwithstanding the many years devoted to its investigation by many able men. A secular change in the position of this Pole has been assumed in more than one theory of the earth's magnetism, and if such motion exists, it can only be determined by positive observation at dates sufficiently separated from each other. During the past few years much light has been thrown upon the curious and interesting relation now known to exist between solar activity and terrestrial magnetism.

An exploration of the kind proposed might contribute facts of great value as bearing on the question of solar influences, and might hasten the day on which a satisfactory explanation of these influences shall be possible.

It is not necessary to enlarge upon a proposition which speaks so well in its own behalf, and I will only

remark in conclusion that an expedition to the region of the Magnetic Pole, if adequately equipped and well organized, cannot fail to be of great and lasting value to science.

As ever, yours faithfully,

T. C. MENDENHALL,
Superintendent.

Professor Marsh, the President of the Academy of Sciences, merely writes a brief note, enclosing the preliminary report of the National Academy of Sciences.

NEW HAVEN, CONN., April 29, 1892.

W. H. GILDER, ESQ.

Dear Sir: I have received your letter of yesterday, and regret that an engagement here will prevent my attending the meeting of the American Geographical Society on Monday next.

In accordance with your request, I will, with pleasure, send to Judge Daly a copy of the official correspondence between the Treasury Department and the National Academy of Sciences, relating to the investigation of the North Magnetic Pole, and the preliminary report of the committee of the Academy on this subject.

Wishing all success to the plan proposed,

I remain, yours, very truly,

O. C. MARSH.

PRELIMINARY REPORT OF THE INVESTIGATION OF THE NORTH MAGNETIC POLE.

(Correspondence.)

THE NATIONAL ACADEMY OF SCIENCES,
WASHINGTON, D. C., January 8, 1891.

Sir: I have the honor to transmit to you, herewith,

a preliminary report made by a committee of the National Academy of Sciences, in accordance with a request contained in your communication of May 22, 1890. The questions relating to the North Magnetic Pole thus submitted to the Academy require more time for examination than was at first expected; but the investigation is still in progress, and I trust I may be able to transmit to you the complete report at an early day.

Very respectfully,

O. C. MARSH,

President of the National Academy of Sciences.

The SECRETARY OF THE TREASURY.

TREASURY DEPARTMENT, May 22, 1890.

Sir: I have the honor to forward herewith a copy of a letter from the Superintendent of the Coast and Geodetic Survey, of April 28, 1890, containing a request for the appointment by you of a committee composed of members of the National Academy of Sciences, or others familiar with the problems involved, to formulate a plan or scheme for a systematic search for the North Magnetic Pole.

As this Department may be called upon, through the Coast and Geodetic Survey, to aid in an exploration of the region containing this Pole, and in view of the fact that the organic act under which the Academy exists declares that it shall, whenever called upon by any department of the Government, report upon any subject of science or art, I respectfully request the appoint-

ment of a committee which shall make report as desired in the letter herewith.

Respectfully yours,

GEO. L. BATCHELLER,
Acting Secretary.

Prof. O. C. MARSH,
President National Academy of Sciences,
New Haven, Conn.

UNITED STATES COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., April 28, 1890.

Sir: The importance of a re-determination of the geographical position of the North Magnetic Pole has long been recognized by all interested in the theory of the earth's magnetism or its application. The point as determined by Ross in the early part of this century was not located with that degree of accuracy which modern science demands and permits, and besides it is altogether likely that its position is not a fixed one. Our knowledge of the secular variation of the magnetic needle would be greatly increased by better information concerning this Magnetic Pole, and in my judgment, it would be the duty of the Government to offer all possible encouragement to any suitably organized exploring expedition which might undertake to seek for this information. I am informed that such an expedition is now contemplated, and in order that such coöperation and encouragement as may be deemed advisable on the part of the Coast and Geodetic Survey may lead to the best possible results, I respectfully request that you communicate with the President of

the National Academy of Sciences and ask that a committee composed of members of that body, or others who are familiar with the difficult problems involved, be appointed to formulate a plan or scheme for carrying out a systematic search for the North Magnetic Pole, in accordance with which the Survey might render such assistance as may be considered possible and desirable.

I am respectfully yours,

T. C. MENDENHALL,
Superintendent.

The SECRETARY OF THE TREASURY.

YALE UNIVERSITY,
NEW HAVEN, CONN., June 16, 1890.

Sir: I have the honor to acknowledge the receipt of your communication of May 22, 1890, containing a request for the appointment of a committee composed of members of the National Academy of Sciences or others familiar with the problems involved, to formulate a plan for a systematic investigation of the North Magnetic Pole. A letter from the Superintendent of the Coast and Geodetic Survey, dated April 28, 1890, explaining more fully the object of the proposed exploration, was inclosed with your communication.

In reply, I have the honor to inform you that, in accordance with this request, I have appointed the following committee:

Prof. S. P. Langley, Secretary, Smithsonian Institution, *Chairman.*

Gen. Henry L. Abbot, U. S. Army.

Prof. William P. Trowbridge, Columbia College.

Prof. Alfred M. Mayer, Stevens Institute.

Prof. Chas. A. Schott, U. S. Coast and Geodetic Survey.

Prof. John Trowbridge, Harvard University.

Prof. Charles Carpmael, University of Toronto.

The members of this committee are all familiar with the important questions to be solved, and will give the subject careful consideration.

Very respectfully,

O. C. MARSH,

President, National Academy of Sciences.

The SECRETARY OF THE TREASURY.

PRELIMINARY REPORT.

BOSTON, November 12, 1890.

Sir: Referring to your letter of the 16th of June and to its inclosure of a letter from the Secretary of the Treasury requesting the appointment of a committee to formulate a plan for the investigation of the Magnetic North Pole; and also inclosing a letter from the Superintendent of the Coast and Geodetic Survey; I have the honor to state that the committee has met, and that, having laid before them the communication in question, they have instructed me to report as follows:

The committee wish to state that, in their opinion, a knowledge of the exact position of the Magnetic North Pole is not so desirable as a study of the changes in the magnetic elements to be obtained from a cordon of stations, stretching from Alaska to Newfoundland,

supplemented also by stations in Siberia, which might be established by the Russian Government in connection with the United States Government.

Since, however, the language of the communications before the committee restricts the question to the best method of determining the exact position of the Magnetic North Pole, they feel that more definite information in regard to the nature of the country in the region to be investigated should be laid before them. They believe that this information can best be obtained from those who have visited the region in question, and that the committee at present can merely make general suggestions, recommending the occupation of a cordon of stations in the neighborhood of the line of dip of 89°; for instance, on Prince of Wales Land, Boothia, near Point Ogle, and on the west side of Victoria Straits.

The committee, however, wish to emphatically state that they only recommend the above stations if they prove accessible. They have no information as to their accessibility, and they therefore express no opinion upon this point.

They desire to state that, in their opinion, whatever points are occupied, or whatever system is adopted, it is of importance to secure simultaneous observations at all the stations; and further that the character of the apparatus to be employed is of such consequence that the committee reserve the discussion of it for a later and more deliberate report.

Your obedient servant,

S. P. LANGLEY,
Chairman.

Prof. O. C. MARSH.
President of the National Academy of Sciences.

Judge Daly then added:

We have, however, present to-night, ladies and gentlemen, three distinguished gentlemen, Professor Trowbridge, Professor Mayer and General Greely. You have welcomed General Greely here before, on his return from his expedition, and it will be gratifying to you all to see him here again to-night.

It gives me very great pleasure to introduce Professor Trowbridge, of Columbia College.

Professor Trowbridge spoke as follows:

Ladies and Gentlemen: The interest that is to be taken in the proposed expedition for finding the present position of the North Magnetic Pole of the earth is not to be restricted to the question whether the Pole be a fixed or a moving point. There is a greater and larger view under which the matter may be considered. The terrestrial phenomena connected with heat, electricity and magnetism, you all know, are uppermost in the minds of all. Everything connected with these subjects is now of the greatest importance to the development and well-being of the human race, inasmuch as they appear to be the primary causes which affect or control nearly all phenomena connected with active terrestrial physics.

This mysterious force of magnetism is at least the evidence of one of the agents, one of the causes, and we know not whether as an electrical phenomenon it may not be connected with the prime cause that initiates our storms, that influences even our vital energies, and controls, indirectly, many conditions necessary to life upon the earth. We know what advances have been

made in our knowledge of electricity and this expedition cannot fail further to extend that knowledge.

Now let us see what is our present knowledge of the magnetic force of the earth in regard to the direction which it causes a magnet to assume in reference to the true terrestrial north and south. It is interesting just at this time to know that Columbus was the first to discover in his first voyage across the Atlantic that on one side of a certain line along which he sailed, the magnet pointed to the west of the true astronomical or terrestrial meridian; and on the other side of this line, it pointed to the east of the true north several degrees. He followed that line of no variation for several degrees. It has been found by subsequent observations, and some of those observations at a single place have extended through several centuries (in Paris nearly five centuries), that the magnetic needle in most places not only does not point to the true north, but its direction never remains stationary in one place. If we take the City of New York, for instance, in 1795 the magnetic needle pointed 8° to the west of the true terrestrial north. It then began a movement to the east, which it reached about 1810, reducing this angle—this westerly angle—about 4°. It then commenced to go back, and it is now going back to its original position and points nearly 8° again west of north.

If you were to go to the west of a line passing through the City of Charleston and extending in a northwest direction irregularly to the Straits of Mackinac, for instance, you would find that this variation is east of north at all points in the United States west of this line, and west of north at all places east of this line at the present

time. During a period of several centuries, however, the magnet at any place swings like a pendulum, in one direction and then back, always pointing away from the true north—at some places more than 20°, on one side of the line of no variation to the west, and on the other to the east. Think of this fact—a movement forward and back which requires several centuries for its accomplishment. What are the causes of this great secular movement? We cannot fathom them now, but we are looking for them and trying to find them out. This secular variation is accompanied by many others. As the magnet approaches its mean position, its secular motion is more rapid; when it reaches its eastern or western elongation it seems to rest for several years. Places to the east of a certain magnetic line, you will remember, have a variation or declination, as it is called, to the west, and places to the west of the same line a like declination to the east. That magnetic line in the United States, in 1795, passed near Washington and Toronto. In 1875 it passed near Wilmington, North Carolina, and Detroit; it now passes near Charleston and the Straits of Mackinac. Along that line a man travelling with a compass would find it pointing directly to the terrestrial north. This line of no variation, moving to the westward, and the grand secular variation, point us to the fact that there must be some corresponding movement of the North Magnetic Pole. But it is not the finding of that Pole which is of the greatest interest. It is the law which governs these great movements that is the ultimate object sought.

In connection with this great swinging of the magnet from west to east, and back again, requiring sev-

eral hundred years for a complete cycle, there is an annual variation very similar but very small. In connection with that there is a daily variation. Every morning throughout the northern hemisphere, as the sun rises, the north end of the magnet moves to the westward, and at about one o'clock it begins to return; toward nightfall it gets nearly back, and before the next morning it gets back again to its first position. This is known as the diurnal variation of declination The extent of this solar diurnal variation seems to depend upon the sun, and is influenced by the spots upon the sun. When there is a minimum number of spots these variations in extent are a min mum; when there is a maximum number of spots, the variations reach a maximum. There are also variations depending upon the rotations of the sun and moon.

You may ask, what is the use of the knowledge to be gained by this expedition? This is a very proper question, although it may be assumed that all new discoveries which extend our knowledge of nature and nature's laws are useful, either intellectually and morally, or in the practical bearings which they have upon the material progress and the welfare and well being of the human race. The answer in this case, however, may be, I think, more specific. We are living in an epoch of the world's history when man is struggling for a higher and more perfect life, not only against the degrading tendencies of his inherited nature, but to make the forces of nature subservient to his advancement and well being. Among these forces there are none which seem to affect or control the conditions of animal life on the earth more than heat, light, electricity

and magnetism, all, perhaps, the manifestations of one cosmical agent. As the variations of the magnetic force appear to follow lesser and greater cycles, it is not impossible that nearly all terrestrial phenomena, which depend on causes allied to magnetism, follow similar cycles. We can now predict the course of storms ; may we not hope to determine their origin, and predict their recurrence, as far as they may depend upon the forces which have been mentioned? A knowledge of the laws of the cycles through which these forces pass is the first and only step in this direction to be taken, and this step must be made by patient, long-continued observations.

As to questions of actual utility in a knowledge of terrestrial magnetism, we know that a ship at sea cannot, in a fog or storm, safely sail without a magnet. It is true that if the sun comes out the latitude may be determined, and the longitude may be kept up by chronometers ; but a ship cannot sail from port to port without a magnet, and it is important to have all these variations, which have been mentioned, determined and predicted for years in advance and put upon sailing charts. Therefore as a mere matter of utility this whole question of magnetic variations and the determination of the poles will add to our knowledge very greatly. I will not refer particularly to the value of the magnet on land, only to say that I think, by law, all magnetic surveys upon land should be prohibited. With these constant variations, there is no telling from one day to another what direction the needle may have. I have not referred to magnetic storms ; yet what are called magnetic storms may cause a sudden variation of

the magnet of such magnitude as to cause serious errors and to vitiate the work of the best surveyors.

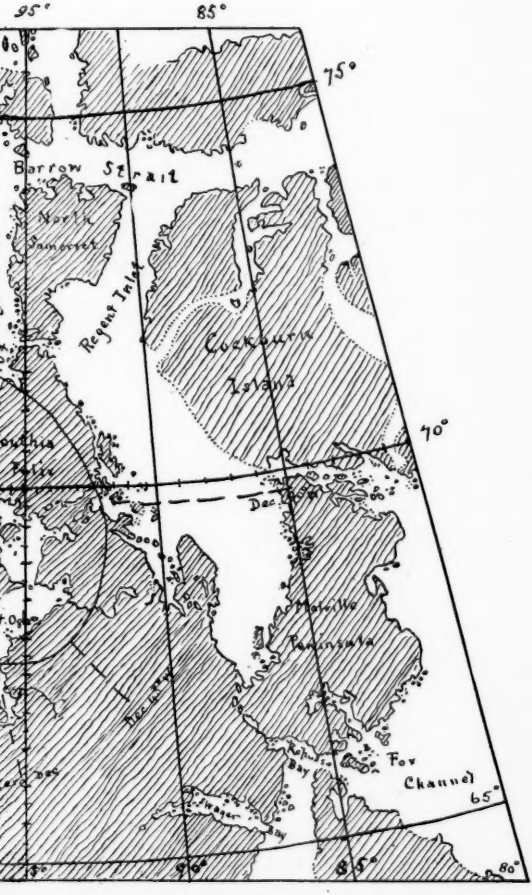
Explorations at the North Pole were originally started with a view to finding a north-west passage for commercial purposes. It was found very soon that the idea was impracticable, and yet explorations were continued. They were continued from time to time merely to point out and discover the northern geographical boundaries of our continent. Incidentally, too, scientific questions of great value came up and were solved, or, at least, facts were gained toward solution. Nowadays, however, it has become rather the duty of men of science, since the northern regions have been pretty well explored, to devote themselves to specific problems, and that which is proposed here to-night is one, the problem of finding the exact place of the North Magnetic Pole of the earth; and when a gentleman comes forward to volunteer his services for this purpose, we ought to give heed to his aims and objects. During the early days of my life, I made a sort of magnetic exploration of the western coast of the United States, and afterward erected a self-registering magnetic observatory at Key West, Florida; but I confess the thought never came into my mind to banish myself from civilization and society and to go to the North Pole in pursuit of this science; and when we see a man ready to do that and to volunteer to undergo the dangers and risks for any scientific purpose, I think he ought to be highly encouraged.

I have here to-night, perhaps it is hardly necessary for me to read it through, a letter from Professor Schott, whose name has been mentioned and who is

probably the best informed on all the details of terrestrial magnetism of all men in this or any other country. This letter embodies the details of what he considers it desirable to do in this expedition. He was a member of the commission alluded to, appointed by the President of the National Academy, at the request of the Secretary of the Treasury, and I am in receipt of Mr. Schott's letter through the late president of the commission. Perhaps this letter will give us an idea of the work to be performed, and the nature of the expedition to the North Pole. And I repeat that when we find these rare men, ready to go to the North Pole and sacrifice their lives, if necessary, to banish themselves from social comforts in behalf of science, I think that we ought to regard them as true heroes and aid them in every way.

I believe that the cost of this expedition, according to Colonel Gilder, will be less than has ever been expended for a scientific expedition to the North Pole where such great results are promised. Fortunately, the probable position of the Pole is comparatively easy to reach, and I look forward to the day when there will be telegraphic communication with those lands; where observers may remain all winter and where telegraphic stations, extending from New York to Hudson Bay, will enable them to procure needed supplies, and where observers may continue their studies. These observations may be the beginning of a series of observations which will result in our ascertaining to some extent the true nature of the wonderful phenomena of magnetism and electricity in connection with the earth

MAP TO ILLUSTRATE A PLAN FOR A MAGNETIC SURVEY OF
THE NORTHERN MAGNETI



URVEY OF THE REGION IMMEDIATELY SURROUNDING
N MAGNETIC POLE.

[Copy, April 21, 1891.]

WASHINGTON, D. C., October 21, 1890.

PROFESSOR S. P. LANGLEY,

Secretary Smithsonian Institution.

Dear Sir: In response to a letter of June 16, 1890, of the President of the National Academy of Sciences, appointing me a member of the committee of which you are chairman, I have the honor to submit herewith a paper on a plan for a magnetic survey of the region immediately surrounding the Magnetic Pole.

I remain, sir, yours respectfully,

CHAS. A. SCHOTT.

REMARKS RESPECTING THE STATE OF OUR KNOWLEDGE OF THE POSITION OF THE MAGNETIC POLE IN THE NORTHERN HEMISPHERE.

Among the questions in the study of terrestrial magnetism there is one of paramount interest—namely, that referring to the position of the poles. It is well known that the one in the northern hemisphere was located with some precision more than half a century ago, but no definite measures have since been taken, either to verify the position or to ascertain whether it persists in that locality or changes its place conformably to the secular variation, as noticed in surrounding regions. There does not appear to be any special theoretical reason for supposing that the poles are either stationary or in motion, and certainly there is no other way of solving the question, except by actually repeating the practical interrogation of nature and trying by observation to locate the present whereabouts of the Pole geographically nearest to us; the other, in the

southern hemisphere, being situated beyond an oceanic region, has remained hitherto inaccessible.

At every point on the earth's surface, where magnetic observations have been made for a sufficient length of time, it is found that the three elements, under which, for the sake of convenience of discussion, the magnetic force is generally considered, are in a state of slow, progressive motion, denominated secular variation. As the name implies, it extends over centuries and is probably of a periodic nature; its cause, however, is as yet entirely unknown. The general surface distribution of magnetism is, in consequence, ever changing in time, and why should the Pole not partake of this movement, though the phenomenon is subject to modification from place to place? This is an argument of those who hold that the Pole is ever shifting its place, according to a fixed law. On the other hand, the position of the direction of the axis of a magnetic body may yet be a persistent feature, though the magnetic intensity upon the whole may change. Dealing with surface distribution, and remembering that the magnetic force at any place depends on the total magnetization of the body, it seems more probable that the Pole has no immunity from the general law of change than that it remains fixed. While some magnetists hold the idea of a large motion even to the extent of carrying, in time, the magnetic around the geographical Pole, and have assigned to it a period of great length, and have actually delineated the orbit or looped path, there are others of less extravagant or better-supported opinion, who would allow but a much more limited motion. Looking at recent iso-magnetic charts, such as those published by the

English Admiralty and the German Marine Observatory, the Pole occupies a position still quite close to where it was found in 1831, but this circumstance may be simply explained by our want of knowledge where else to place it. We here approach the practical part of the question relating to navigation. Sometimes confusion has arisen from want of discrimination of properties, respecting the number of poles existing, and it may not be deemed out of place here to state that this paper has no concern with the two foci of maximum total intensity of magnetic force found in the northern hemisphere, and which should never have been termed poles. The American focus of intensity lies to the south of Hudson Bay, between it and Lake Superior, and is the stronger one of the two. At the Pole, properly so-called, there is a coincidence in gravitational and magnetic forces; hence the horizontal component of the latter, as well as the declination, vanish, and the dip becomes 90°; the total intensity, identical with the vertical component, is estimated to be at present not far from 0.62 of a dyne.

The first definite location of the Pole is due to Sir James Ross, who, in the spring of 1831, found himself in a place on the shores of Boothia where the dip was 89° 41′, and the declination 57° W., whence he concluded that the Pole should lie in that direction at a distance of about thirty-five miles. He reached the calculated position June 1st, in latitude 70° 05.′3 and in longitude 96° 45.′8 W. Here the dip was 89° 59′, and no difference sufficient to point out a magnetic meridian could be perceived in the times of oscillation of the needle in various azimuthal planes. This place is

marked by a star on the accompanying map. The locality was approached from the south by Captain Back, when, on August 12, 1833, at Point Ogle, north of the Great Fish River, in latitude 68° 14′ and in longitude 94° 58′ W., he observed the dip 89° 24.′2 which, in a measure, confirms the position previously found. A third important determination of dip in this vicinity, though at a greater distance, but at a later date, is that of Sir Francis Leopold McClintock, at Fort Kennedy, Bellot Strait, in latitude 72° 00.′8 and in longitude 94° 19′ W. Here, in 1858, the dip was 88° 27.′4 and the declination 135° 47′ W., and the latter quantity would seem to indicate that in the meantime the Pole had moved farther to the westward. Thus the oval-marked dip, 89°, on the map, and which was taken from a paper by Captain Evans, hydrographer to the Admiralty, and supposed to answer for the year 1875, has its centre somewhat to the west and south of the position marked by the star. As a piece of useful knowledge to an explorer, it may be stated that a change of 1′ in the dip will roughly correspond to a change of distance of about two statute miles in a direction at right angles to the oval and inwards. The latest information we have is by Lieut. F. Schwatka (*Science*, of Feb., 1885), who visited King William Land in 1879–80. He places the Pole in longitude 99° 35′, as marked on the map by a heavy vertical dash, or about sixty-five nautical miles due west of Ross's position, but retaining the latitude given by Ross; his reasons for placing the Pole, in 1879, so far westward, are given in the article referred to. He says: "When at Cape Felix, the most northern point of King William Land, the needle (of an extremely

delicate compass) remained sluggishly in almost any position that was given it; when pointed in a N. E. and S. W. direction, I thought I detected a slight tendency to move to the westward." At Franklin Point, about thirty-five statute miles south and west (true) of Cape Felix, the needle showed a little activity at longitude 99°; near Point Little, about twenty statute miles east of Cape Crozier (the western cape of King William Land), "I took the largest and most careful series of observations, and the needle always returned to within 18° of the Pole as I have located it. . . ." According to Lieut. Schwatka's firm belief, the position of the Magnetic Pole in 1879 was between longitude 99° and 100°, but with its latitude undetermined. From what has been stated it would appear probable that the present (1890) position of the Pole lies to the westward of King William Land somewhere in Victoria Strait; hence it will be necessary for the explorer to be prepared to cross that channel and extend his magnetic survey to Victoria Land. It is desirable that Ross's station be revisited.

MODE OF APPROACH TO THE MAGNETIC POLE.

Suppose the observer ready to start from his landing place or camp after he has attended to the necessary magnetic observations, as mentioned in detail further on, he may first direct his course towards the western shore of King William Land by the best route in his judgment. Magnetic stations should at first be made at long intervals, say 50 miles apart, in order not to impede the progress of the party while on ground yet outside its more important field of research; after-

wards, when approaching a dip of 89° they should be located closer together, say at distances of 30 or 20 miles, according to circumstances. Before that isoclinic curve is reached, the explorer will know by the direction of the magnetic meridian, as shown by his azimuth compass or declinometer, whether or not his steps are likely to carry him too far to the east or to the west, and he will be guided accordingly. The magnetic meridian thus pointed out at a station is a tangent to the curve, but as the curvature is small, and, moreover, every additional station gives a new direction, he may follow it as far as desirable or practicable. Lines drawn in the direction of the magnetic meridian from a number of stations where the dip exceeds 89°, will fairly meet in points covering a sufficiently defined area, the central part of which may be taken to include the place of the Pole.

To estimate the distance from it, the observer may take the difference in minutes of arc, between dip 90° and his observed dip, and allow from 1¼ to 2 statute miles of distance for each minute of dip. In this rough way the observer can gain a fair knowledge of the position of the Pole.

PHYSICAL CONDITIONS IN THE VICINITY OF THE POLE.

An observer who should expect to plant his dip-circle right over the Magnetic Pole would likely be disappointed, on account of local irregularities in the distribution of magnetism, which may indicate the possible presence of more than one spot with dip 90°. Such irregularities are met with even in localities where the surface strata would apparently give no indication to

suspect local disturbance, but they are largely developed over regions abounding in igneous rocks and, in particular, near great faults, and in basaltic formations, and in localities of trap-dykes, no matter whether they crop to the surface or are concealed below. Within that limited region where the explorer expects to find the Pole, he should multiply his stations by distributing them over a number of square miles, and thus provide the means for developing and exhibiting the local peculiarities of the limited area. From it, as a centre, a few lines should be run outward so as to secure half a dozen or more stations *completely surrounding* the area at a distance of a few miles. It is, of course, about an equal chance that the Pole is located over a land or a water area, and it may be impossible of exact fixation in position either by reason of inaccessibility through ruggedness, or by reason of being water-covered, or from instability of ice. Nevertheless, the object of the expedition would be completely gained if observations were secured at a sufficient number of stations so located as to *surround*, as near as may be, the place of the Pole, though no one observation may reach within $\frac{1}{4}^\circ$ of vertical dip. It is clear that the point is gained, if we have the means of satisfactorily locating the isoclinic curves of (say) 89° 30′, 89° 40′, and 89° 50′.

TIME REQUIRED FOR THE RESEARCH.

This will depend in a measure on the strength of the organization and on the accessibility of the Polar region. Owing to the shortness of the season when travelling is practicable, whether by sledge or boat, or by both, a single observer would certainly need two

seasons, and even two observers would have no time to spare when aiming at a complete magnetic survey. It would seem desirable for other reasons that two observers take part in the work, to guard to some extent against interruption through sickness or against accidents to instruments. At all events the party must be prepared to spend two winters in this region.

DETERMINATION OF GEOGRAPHICAL POSITIONS.

The observations for positions of the magnetic stations should be regarded as of equal importance with the magnetic measures, since without reliable positions the latter could not be properly utilized; besides they will furnish the means for improving existing maps and will form the basis for the delineation of any new topographical features the survey may develop. It is recommended that the latitude and longitude of some place of the route should be observed daily, weather permitting, and that a record be kept of the direction of travel and of distances estimated, so as to bind the observing stations together and assign to them their geographical co-ordinates. It is recommended that observations of circummeridian altitudes of the sun be taken for latitude, and observations of equal altitudes of the same object be made for longitude, the latter to be differentially reckoned from the landing place, starting point or winter quarters, as the case may be. Time will be kept by two pocket chronometers to be carried on the person of the observer for the better preservation of uniform rate, as they will then be least exposed to variations of temperature. The dates should be noted according to civil reckoning and the hours should

either be recorded from 0 to 24, or to any time set down there should be added A.M. or P.M., as the case may be. A time-piece with face graduated to 24 hours should be procured preferably to one of the usual pattern, since records from the latter, not infrequently, are a source of doubt or annoyance to the computer in the determination of rates, unless in the use of 12 hours twice over the record is accompanied by a proper sign. The sun may be observed for azimuth at any time of the day, the chronometer correction for local time being known as well as the latitude of the place. Observations for time are made most advantageously when the sun is in or near the prime vertical, but they should not be taken within an hour and a half from noon. A small altazimuth with circles of 10 or 13cm. (4 to 5 inches) diameter, such as frequently form part of a magnetometer, will suffice for the determination of these geographical positions. With an instrument of this size the latitude can readily be fixed within 1′ of arc, but the inferior accuracy attainable for longitude must depend largely on the stability of the chronometer rates. The position of the permanent camp should be made to depend for its latitude on observed altitudes of Polaris, and for its longitude in the first place on local time observations (sextant and method of equal altitudes) in combination with the rated ship's chronometers in the voyage out and again in the home run; this longitude is to be checked by a series of lunar distances; should, however, the organization of the party admit of it, observations of moon culminations are recommended, in which case a small transit would have to be provided. Should it become necessary to

use an artificial horizon, as a precautionary matter in case of breakage of the level attached to the transit axis of the altazimuth (or theodolite), a black plane glass horizon with spirit level attached is preferable to a mercurial horizon.

It is desirable to insert in the record book a description of the stations, however rough or hurried, and for more important ones to accompany it by angular (theodolite) measures of surrounding distant objects, to be used for locating route lines or for topographical purposes. It is strongly recommended to mark in some way, at least the prominent magnetic stations and to give such descriptions as a party may need when endeavoring to reoccupy the stations at some future date. A small cairn placed over the station would sufficiently attract the attention.

THE MAGNETIC OBSERVATIONS PROPER.

They will comprise the measure of the three elements, the declination, the dip and the intensity which fully define the magnetic force at a place. The measures will be partly absolute, partly differential, and will be considered under two heads, viz.: those to be taken while travelling and those to be attended to at the winter quarters.

(*a*) Observations at the permanent station:

They are intended in the first place for the determination of the direction and intensity (in absolute measure) of the earth's magnetic force, also in part to elucidate the law of the diurnal variation of the declination, and secondly to supply the needful data for the conversion of the differential observations made while

travelling into absolute measures. It is recommended to make regularly once each week sets of observations as follows: Hourly or bi-hourly readings of the declination magnet continued for 24 hours, beginning at midnight (local mean time) on Monday (say) and ending with the next succeeding midnight; for the purpose of determining the declination, in connection with these differential measures, the reading of the azimuth circle must be connected with the reading of the mark, the direction of which is known from astronomical observations. At some convenient hour (always the same) on Tuesdays, observe for dip (including all reversals), to be followed at once by measures of the variation of the total force by Lloyd's combination method of gravity and magnetic deflections of the dip needle. Next there will be made observations of oscillations and of deflections with the magnetometer to give the value of the horizontal component of the force (to be expressed in C. G. S. units).* The original record should be duplicated and should be absolutely free of any computation other than is needed for making the observations. The reductions should be attended to by the observer and be made in a special volume or on the blank forms usually provided. It is also desirable to test the instrumental constants as previously determined at the home station.

(*b*) Observations while travelling:

These will consist of measures of declination with a very sensitive prismatic compass or other *specially designed* instrument to allow the utmost freedom to the

* The observer should consult "Directions for the Measurement of Terrestrial Magnetism," Appendix No. 8, U. S. Coast and Geodetic Survey Report for 1881, also the Admiralty Manual of Scientific Enquiry, London, 1886.

horizontal needle to respond to the feeble horizontal component of the earth's magnetic force. A needle delicately suspended on a single cocoon thread is known to respond to the changes of the horizontal magnetic force at places where the dip is near 89°, and may suffice even for places where 0–89½°, and probably still closer. The most delicate suspension is thought to be that of a spider thread carrying a (sewing) needle. It should be remembered that within the region under survey the diurnal variation is to be measured by degrees rather than by minutes, as in lower latitudes, and that disturbances reach over arcs covering a large part of a quadrant. There is therefore no need for great accuracy in the astronomical azimuth of the mark.

The observations for dip, the most important of the survey, will be made with a Kew Dip Circle employing two needles; the usual reversals of circle, face and polarity should be attended to at each station. To place the instrument in the plane of the magnetic meridian, the usual method of finding it by means of the verticality of the needle, when in the plane of the magnetic prime vertical, it is supposed will not answer here for want of sufficient accuracy, no more than a determination of the dip by means of oscillations made in the magnetic meridian and in the magnetic prime vertical would give satisfactory results when $o > 6°$ (about). The direction of the magnetic meridian should, therefore, be taken as indicated by the delicately suspended needle of the declination instrument—where this method finally fails, dip observations should be made in any two planes, 90° apart, of which the first plane is prefer-

ably that of the meridian as guessed at. The circle should be of the kind supporting its needle on a horizontal bar, unless the opening through the vertical support is very much larger than usual.

The observations for intensity will be made at all stations, as far as practicable; they will consist, in the first place, of oscillations of the declination needle to be made in the ordinary way for the measure of relative horizontal intensity. These observations need not extend over more than ten minutes of time; the temperature of the magnet must be noted. The method, however, will soon become impracticable, and finally fail as we approach the higher dips. The following method has the advantage of applicability at all places, and, in particular, in high latitudes, and is, in a measure, independent of the effects of temperature of the needle; it is known as Lloyd's and consists in deflections both by gravity and by magnetic induction. For this purpose the dip circle is provided with two additional needles known as intensity-needles, the poles of which are never reversed. The small weights used as deflectors under gravity, however, are very troublesome to handle in an Arctic climate, and it is proposed to substitute for them the aluminum disk (pulley with suspended weight) of the Fox circle. Anywhere in the region the observer may also make use of the coarser method, already referred to, of oscillating the intensity-needle both in the plane of the meridian and again at right angles to it, noting also the temperature; these measures will give relative value for total and for vertical forces. The above observations for intensity are all relative and demand similar observations at the

base station (winter quarters) to be made just before setting out, and again immediately after return to it, in order to furnish the data for the conversion of relative into absolute results. All intensity measures should be expressed in units of the C. G. S. system. The observer will find it desirable, if not indispensable, to train some one to assist him in recording the observations, and, in particular, for noting time during oscillations. To recapitulate respecting the proposed magnetic instrumental outfit, there will be needed :

(1) At the permanent station : an ordinary magnetometer of the Lamont, or the composite pattern of the Coast and Geodetic Survey ; if of the former, a small altazimuth instrument must accompany it ; a box chronometer and a Kew Dip Circle especially fitted for Lloyd's intensity method.

(2) While travelling : the same altazimuth and the same Kew Dip Circle, with its four needles, a specially constructed declinometer and two mean time pocket chronometers. Blank forms for recording to be carried.

It would not be advisable to charge the party with any but the absolutely necessary operations in order to secure the best attention to them, and from what has been said above, it will be apparent that much of the success of the undertaking will depend upon the skill of the observers and on their resources under the necessarily adverse circumstances under which the work is to be carried out. C. A. SCHOTT.

Judge Daly: I have the pleasure of introducing Professor Mayer, of the Stevens Institute of Technology,

Hoboken. I need not say anything about the Professor. To most of you present, he is known as one of the highest authorities on the subject of magnetism.

Professor Mayer spoke as follows:

Ladies and Gentlemen: My friend. Professor Trowbridge, has so exhausted this subject that he has left me very little to talk about. But I was asked by Judge Daly to address you and to try to excite some interest among those who knew little of magnetism—or we would suppose that they knew little of magnetism. I will try to be clear. Fontenelle said that the first evidence of politeness in one who addressed an audience was to be clear, and I shall endeavor to be polite.

I am going to take you a long way back. The remote cause of this meeting is a book published in 1600. It is a book written in Latin. In English, the title is, "On Magnetic Bodies: The Great Magnet the Earth." It was written by William Gilbert, physician in ordinary to Queen Elizabeth. Before Gilbert's day the modern method of investigating Nature was unknown. In his book, "De Magnete," Gilbert shows us by his experiments and by the way he interpreted them, how to make discoveries in physical science, thus anticipating what Bacon attempted in his over-lauded work, the "Novum Organum." Bacon thought little of Gilbert; he said Gilbert was trying to make a whole philosophy out of a magnet. Gilbert did make a whole philosophy out of a magnet. The teaching in Gilbert's book gave us the true scientific method of studying nature, and the date of its publication marks an era in the progress of knowledge. In this book Gilbert made known all

the fundamental facts of magnetism. These he so arranged that they became their own interpreter and showed it highly probable that the earth itself is a great magnet.

I will explain one of Gilbert's experiments. He had several magnets made of large masses of loadstone. He had a mass formed into a sphere. Now, on putting pieces of iron to that sphere, it was very soon found out where the maximum attraction existed. These two points were diametrically opposite, and he called them the poles. He then took a magnetic needle, delicately suspended so that it could point in any direction, and moved it over the magnet. He observed that when he moved the needle over to where the iron had been most attracted, it was in a vertical direction. It was a prolongation of the axis of the sphere. He now moved the needle, and immediately it formed a smaller and smaller angle with the sphere, and when it got down to the equator it was parallel to the diameter. Then the other end of the needle dipped up until it got to the south pole when the needle again stood in line with the diameter of the sphere. If you divide that sphere, as he did, by meridians and circles of latitude, you will find, as he found, that the needle always points in a meridian; that is, it was always true north and south, and the dip increases as it goes to the pole, and at the equator it is horizontal. He called the line on the sphere where the needle was horizontal, the equator of the magnet, and where it was vertical, it marked the poles.

As I understand the words, there is a great difference between hypothesis and theory. They are con-

stantly confounded. Buffon gave an excellent definition of these words, and that definition has been accepted in the working of scientific men. He states that hypothesis is the explanation of facts by possible causes. Theory is the explanation of facts by real causes. So theory, to a man of science, is the most certain knowledge that we have. We have theories of dynamics, of gravitation, of sound, but we have no theory of electricity or of magnetism, because these sciences consist of explanations of facts by possible causes. Now, this theory of Gilbert's was really an hypothesis. He reasoned from analogy, as all men do who investigate Nature. Twenty-five years before that, the dip had been discovered by Norman of London. Would you like to know how he found the dip? He reasoned in this way: Does the earth attract the magnet? If it is free to move, will it move toward the Magnetic Pole of the earth; does it weigh more when it is magnetized? To determine that, he weighed magnets in a delicate balance and then magnetized them and found no difference. He then put a magnet through a cork, so that it floated midway in a column of water. In one of his experiments, to his surprise, he found that it did not stay in a vertical line, but inclined to the horizon and dipped. He then made what was called the dipping needle, which is substantially the same instrument as will be used in this expedition.

Now, Gilbert's hypothesis was proved by Hudson, in 1608, who discovered, in latitude 75° 22′, the dip of the needle to be 89° 30′, as Gilbert had predicted. The variation of the needle was known to navigators before Columbus's first voyage to America. Gilbert's hypoth-

esis did not account for the variation. Then it was assumed that the Magnetic Pole did not correspond with the exact Pole. The Magnetic Pole does not correspond with the geographical Pole. Suppose it is 20° south of it, as it is, then it is very evident that if you are right south of the Pole, the needle will point north. There will be no variation on that meridian. As you go east of south, the needle will evidently point to the west, and as you go west of south it will point to the east. Therefore, on one hemisphere it will have a westerly and on the other hemisphere it will have an easterly movement. Halley, a contemporary and friend of Newton, during a voyage sent out by the English government, found out, when he came home and discussed his observations, that the variations he observed could only be explained by assuming four magnetic poles, two in the northern hemisphere and two in the southern. That is the origin of the idea of the two magnetic poles in the northern hemisphere and two in the southern. Gauss takes up that idea of magnetism and magnetic forces in his masterful work on terrestrial magnetism. This is not a theory of magnetism, because we do not know anything about the agents acting here and we cannot predict what will happen at some distant period.

Now we come to this subject of four magnetic poles. Halley had no means of measuring the magnetic intensity. It was not measured in his time. But now we know that there are four regions of magnetic intensity. The strongest is in the northern region, between Lake Superior and Hudson Bay. There is another in the northern hemisphere from the Lena

River to the west. There are two other foci of strong magnetism in the southern hemisphere. They are close together. They are between Australia and the Antarctic Continent. Assume that those centres of force have been determined by observation. Since the time of Halley, observers all over the world have made observations of the condition of magnetism of the earth. We find that there are four lines of no variation, as there should be; or there are, rather, two lines and then an oval, which makes two more lines. These facts formed the basis of Halley's hypothesis of two poles in each hemisphere; then, as you divide the earth into four parts, the opposite sections of the earth will be, east declination to the west, and to the west will be east. That is what you find as you go around the earth. You find those four variations of east, west; west, east.

You have come here to listen to some talk about this expedition to find out the North Magnetic Pole. What is your idea of a magnetic pole? It is not the area of maximum force. In the case of a long hard steel magnet, the pole would correspond with the maximum force. The magnetic lines of the earth are constantly fluctuating. The magnetic equator does not follow the terrestrial equator. The lines of variation are very irregular, converging, however, to two magnetic poles. We can tell the position of the Pole by the attraction. What we want to find is what we call the verticity of magnetism. That is, where the dipping of the needle will be vertical. That is the point we wish to determine: where the magnetism of the earth will so act on the needle that it will point in

a vertical direction. James Ross got an approximate verticity at this point. I will recall to you some historical facts. In 1580 the declination, the variations, of the needle in London were observed to be about 11°. In 1600, in the time of Gilbert, it was about 8°. In 1657, the needle pointed north. You see it had moved from the east. It then began to move to the west, and moved to the west for 161 years, until 1818, when it had moved 24¾ to the west of the meridian. That was the variation in London. Then it came back, and from 1818 to 1892 it has moved from 24¾ west to about 17¾ west. Now, observe this great cycle. In 161 years it has moved from its meridian to its extreme westerly swing; now it is coming back again. It has gone from its extreme swing back one quarter. In the remaining number of years will it come back? Now, what are the causes of that? That is what we are trying to find out. As Professor Trowbridge has stated, there have been various hypotheses as to those lines of variation on the earth's surface. One is that the Magnetic Pole is in motion. It is deep down in the earth, and that pole is moving, and it is very evident that if you were to take a magnetic needle and then have another powerful magnet off at some distance, that you could deflect the magnetic needle by moving the large magnet. We want to know, does it move; has it moved? Does that pole move to and fro in a line straight or curved, or does it move in an orbit? We wish to see an American expedition go to the North Pole to make an observation on a point of that orbit, if it be an orbit. It may be a fixed pole, not a planetary pole. What has been done? Science has

determined one of the points of that orbit—only one orbit. Americans wish to determine another point. Subsequent observers fifty years hence, when we are all gone, will make another observation, and so they will go on; and in the course of time, it may take three centuries, the motion of that pole, if it has a motion, will be determined. I do not know of any object in science more interesting than the object of this expedition. We can do it. Americans should do it. They should plant the American flag on the North Magnetic Pole. We do not go up there to find some passage. We know what we are to find. It has all been planned out by one of the most eminent magnetists of the world, Professor Schott. From his study of observations taken all over the world he knows exactly what is to be done. There is no doubt that this expedition, if organized, will reach the North Magnetic Pole and will show whether that Pole is a fixed pole or a planetary one.

Judge Daly: It affords me very great pleasure to introduce General Greely.

General Greely spoke as follows:

Ladies and Gentlemen: It is with a peculiar feeling that I speak again in Chickering Hall and to the Fellows of the American Geographical Society and their friends. Some seven or eight years ago such a cordial and enthusiastic reception was given me here as must always abide in my mind. It was well and truly said to me then, by an American, that that homage, whether due or not, paid to me by my fellow-

countrymen, by the representative Geographical Society of this country, would give me greater pleasure, far, than any honors which might come to me, as they have since come, in other lands. And so I always have had, and always shall have until my dying day, a great affection for the American Geographical Society, and a kindly feeling for Chickering Hall.

But I came here to-night, not for reminiscences, but to speak concerning the proposed expedition for the magnetic survey of King William's Land, which Colonel Gilder proposes to lead, and which I hope will be sent forth by American money and under American men. The spirit of unrest has well been outlined in that wonderful description of Ulysses,

> "I cannot rest from travel . . .
> . . . my purpose holds
> To sail beyond the sunset, and the paths
> Of all the western stars, until I die."

And when a man seeks to travel, to pass out between the Pillars of Hercules into the unknown regions, we know that, in that respect, he shows himself like to his fellow-kind. But, when we get beyond the general principle, we find some special reason which causes each man to travel, something that impels, which turns him in that special direction. You have not far to go to find the impulse which, I hope, will send Colonel Gilder north again, because it turns back a leaf in his own history, but still more leaves in the history of the English-speaking race.

Those who have crossed the ocean, who have passed into the great Westminster Abbey, have read there, if they chose, or if they took an interest, upon a white slab a verse of Tennyson's; it reads:

"Not here; the white North has thy bones; and thou,
Heroic sailor soul,
Art passing on thine happier voyage now
Toward no earthly pole."

It is a tribute of the Poet Laureate to Franklin, a man who, in his work, represented the remarkable spirit of investigation which has characterized England, and which has made it the country it is. The story of that expedition is not to be told here. I will allude briefly only to the last days of it and to the wonderful march, which—after Franklin had died and had been committed to the icy deep he had sought in the last years of his life—those men made down the west coast of King William's Land. The tribute paid to these men is, to my mind, one of the highest tributes ever paid to the firmness, the resolution, the courage, great as these are, of the Anglo-Saxon race. When, in later years, there were found some Eskimo who had seen some of the Franklin crew, they told in these touching words the history of that march: "As they walked along, they fell down and died." These men died in action, as the best and bravest of the Anglo-Saxon race have so often died, and such action has given life to the maxim that "He dies best who dies by use and not by rust."

In regard to expeditions of this kind, there are three points concerning which an American public ask information: (1) For what good? (2) Is it practicable? (3) (Especially in connection with Arctic expeditions) Is it safe?

Concerning the desirability, the scientific experts have spoken with such force that none, I think, can doubt their truth. Although not, perhaps, what you might call a scientific man, yet I may add a little to

what they have said upon that point. In my journey north, some nine hundred miles (statute miles), to the north of the Magnetic Pole, in settling upon the east coast of Grinnell Land to do the scientific work which I was charged with, I made a great sacrifice to my feelings of ambition for geographical work, because if I had landed upon the Greenland side, I would have been able to have gone not only to the farthest north of that time, but many and many a mile beyond. However, I bore in mind the necessity of uniting my scientific work with others, and so, reluctantly, very much to the detriment of my geographical work, I landed on the west shore. The observations made by me there, in conjunction with those of the English expedition some seven or eight years before, were the first observations which enabled experts, through Professor Schott, the chief among them all, who has been alluded to here to-night, to determine the annual secular variations of the magnetic needle in Smith Sound. It was further found that the average annual diminution of the dip, already fixed at 1′, was now changed to an average annual increase of 1.5′. So this much was added to our knowledge by these observations.

Wherefore do we speak of this work as being so important? The relation of magnetism to the other branches of physical science is becoming more and more evident, and it was with a feeling of especial pleasure, when I attended the final meeting of the International Polar Commission at Munich last September, that I presented to it the hypothesis of Professor Bigelow, in which he pointed out what he thought to be the evidences showing the inter-relation between

magnetism and meteorology. One of the most distinguished of German philosophers and scientists, Dr. Neumayer, agreed with another of the most distinguished of the French, Professor Mascart, that this did bear out part of Gauss's theory. It is conceded that we may hopefully seek a solution for many of the important points, now doubtful and obscure in physical sciences, in more accurate magnetic observations, and in the discussion of the mass which we have already collected.

Passing on to the point as to whether this work is practicable, I can simply say that no doubt can exist if we base our opinion—as we must base it—upon what has been done in the past. Taking the great circle which is outlined here around King William's Land (indicated on the map), it is evident to all having a thorough knowledge of Arctic history that this portion of the Arctic regions has been visited more frequently, and with less danger and less loss of life, than any other within the Arctic Circle. We have the five years of Ross, from 1829 to 1834; we have the work of Parry, Lyon, and Allan Young's voyage later into Bellot Strait. Again, an American, Hall, lived five years in this country. To the west, the remarkable voyage of Collinson, extending very nearly into Victoria Strait. Then, again, the last voyage of McClintock, in which he succeeded in reaching King William's Land. Again, two or three winters of Rae, at Repulse Bay, where this expedition proposes to have its headquarters. Back, King and Anderson made voyages down the Great Fish River, and then, after all, the very remarkable and extraordinary journey of Schwatka and Gilder,

a journey which, I may safely say, will link their names with English history as long as the walls of Westminster Abbey shall stand, and as long as that stanza of Tennyson's shall be engraved upon its marble slab.

All these expeditions which I have mentioned approached King William's Land either from the west or the east or the south. One expedition only, the fatal one of Franklin, came from the north. That expedition was not one attempting to hold to land, as all these other expeditions did, but one venturing into the ice pack for the discovery of the North-West Passage, and from that, and the further fact that those vessels were dependent on sail power, may be attributed the fatal outcome of the voyage of Franklin. In connection with the expeditions that have entered this region since that time, the fatality resulting therefrom has been no greater than would occur among the same number of men of the same age, living for the same length of time in New York City. As for the safety of this expedition, having, as it will, a land base at Repulse Bay, and going overland to the strait separating it from King William's Land, it will pass over a country thoroughly familiar to Colonel Gilder, quite thickly peopled with natives, and covered for the greater part of the time with game.

There is no doubt that such an expedition is desirable, is practicable, and is safe. I shall be gratified if any word that I have said here to-night, any opinion which I have expressed, shall induce any hearer to give substantial aid for this expedition. I think that any contributor will be doing a service to his country in insisting that this important work, so promising for

science, shall be done by Americans and under an American, with that spirit of resolution, of courage, and of enterprise which have made the United States of America the greatest of all civilized nations.

Judge Daly:

Ladies and Gentlemen: We are now about to close, but before we depart, I will introduce Colonel Gilder. He is not a speaker, but probably you would like to see him.

Colonel Gilder spoke as follows:

Ladies and Gentlemen: I do not see that there is anything left for me to say. You have had the scientific features of the proposed expedition presented to you by people who understand the matter, and General Greely has spoken from his own experience of Arctic work, and from what he knows from reading. He has expressed his opinion of its practicability, so I do not see that there is anything for me to add.

I might say, however, that the Committee of the National Academy of Sciences had some hesitation to recommend this work, fearing that the Pole might be found over the water, which you see on the map, but that is no impediment to travel there, because it is filled with ice about twenty feet thick, as I found it when I was there a few years ago. Therefore there is no trouble whatever in travelling anywhere there with sleds. The only difficulty might be that, in following Professor Schott's recommendation that we should leave a cairn to mark the spot where we found the pole of verticity, the ice movement might carry that cairn

out of the way, and under such circumstances a re-visit would not be so valuable. But the plan of survey comprehends a surrounding of the Magnetic Pole, and in that way we will always be able to find the point again.

I propose to make Repulse Bay the position of a permanent station. It is the nearest point to the Pole of Ross that can be easily and safely reached by ship, and lies only about three hundred miles from it, in a direct line of overland journey that has been traversed a number of times. It has been crossed by Rae and by Captain Hall, and to the west of that by Lieutenant Schwatka and myself, and by several others. It seems the most practicable route to the pole-containing area.

The strait between the Pole of Ross and King William's Land was crossed at the time that Ross established the pole. He crossed to King William's Land and went several miles down the coast to the point he named Victory Point, where he left a cairn. Afterward when McClintock wintered in Bellot Straits in 1858–59, he and Lieutenant Hobson, his first officer, came down this coast in the spring and crossed over to King William's Land. Hobson went down the west coast and McClintock went by the east coast to Montreal Island. Hobson in going past Victory Point found the only record that has ever been found of the Franklin expedition. That is a record that was left first by Lieutenant Gore and de Vaux and afterward it was written on by Captain James Fitzjames, who landed there with the survivors of the Franklin expedition under Captain Crozier. After leaving Victory Point, Hobson journeyed on down the coast and got as far as Cape Herschel on the south side, and a little beyond

that, where he left a cairn with a memorandum in it for McClintock, who was to come up that way on his return to the ship.

When McClintock found this record of Hobson's, in which he stated that he had found the Franklin record and had to return to his ships, being pretty well used up with scurvy, McClintock followed him up and left his record in place of the one left by Hobson. That is the record Lieutenant Schwatka and I brought home after leaving a copy of it there with our own.

Victoria Strait, on the west, was crossed by Rae, and by Collinson, and there is no trouble whatever in making the journey. I won't say that there is no trouble, but it is not impossible by any means; it is merely rough ice travelling.

It is practicable, and if it is practicable, it is a work that ought to be done.

GEOGRAPHICAL NOTES.

BY

GEO. C. HURLBUT, *Librarian.*

GEOGRAPHICAL SOCIETIES, JOURNALS AND CONGRESSES. —Dr. H. Wichmann has sent his review of geographical organizations and journals, brought down to 1891, and filling pp. 463–484 in the *Geographisches Jahrbuch* for that year.

Since the last review (1888) three societies have been revived or changed, and nine new societies have been founded: one at Newcastle-on-Tyne, one at Genoa, one at Christiania, two at Helsingfors, one at Moscow, one at the City of Guatemala, one at La Paz, Bolivia, and one at Ouro Preto, Brazil.

There are now in existence 113 societies (with 45 branches), established in 147 cities, divided among 24 countries.

France has 31 societies, with a total of 18,650 members; Germany 23 societies and 8,960 members; Great Britain (and the Colonies) 10 societies with 7,600 members; Italy 5, with 2,470 members; Austria-Hungary 3, with 1,830 members; Switzerland 6, with 1,788 members; the United States 3, with 1,760 members; Belgium 2, with 1,450 members; Russia 8, with 1,350 members; The Netherlands 2, with 1,230 members; Portugal 1, with 1,186 members; Sweden and Norway

2, with 1,156 members; Argentina 2, with 1,000 members; Brazil, 5 societies and 700 members; Denmark, 1 society with 510 members; Spain, 2 societies and 426 members; Romania, 1 society with 233 members; Japan, 1 with 200 members; Mexico, 1 with 150 members; Egypt, 1 with 100 members, and Guatemala, 1 society with 60 members. Dr. Wichmann has no data for the societies at Lima and La Paz.

The largest societies are: The Royal Geographical, 3,579 members; The *Zentralverein für Handelsgeographie*, Berlin, 3,000 members; the Paris *Société*, 2,300; the Reims *Société* 1,700; the Paris *Société de Géographie Commerciale*, 1,650; the Lille *Société*, 1,550; the Royal Scottish Geographical, 1,495; the American Geographical, 1,427; the Paris *Société de Topographie de France*, 1,228; the Lisbon *Sociedade*, 1,186; the Vienna *K. K. Geographische Gesellschaft*, 1,180; the Rome *Società Geografica Italiana* 1,115; the Tyneside Geographical, 1,100; the Berlin *Gesellschaft für Erdkunde*, 1,049; and the *Union Géographique du Nord de la France*, at Douai, 1,044. No other Society has 1,000 members. There is, perhaps, a typographical error in the number of 1,700 members credited to the Reims *Société*. This Association, founded in 1884, figures in Dr. Wichmann's review for 1888 as a doubtful quantity, with a mark of interrogation against it in each statistical column; and the rise from nothing to 1,700, in three years, gives the reader pause.

It is difficult to make a complete list of geographical journals. Dr. Wichmann enumerates 146, of which 118 are published by Societies. Fifty-two are in

French, 43 in German, 12 in English, 8 in Russian, 8 in Italian, 6 in Spanish, 5 in Portuguese, 3 in Dutch, 2 in Danish, 1 each in Swedish, Hungarian, Romanian and Japanese, and 3 in several tongues (that of Quebec in English and French, the two at Helsingfors in Swedish and Finnish, with numerous contributions in German and French).

Two journals are published in Africa, 4 in Australia, 8 in Asia, 13 in America, and 119 in Europe.

In his remarks on the International Congresses, Dr. Wichmann passes over the First Congress, held at Antwerp, in 1871. The true International Congresses were those held at Paris (1875) and Venice (1881). The Fourth Congress (Paris, 1889) and the Fifth (Berne, 1891) fell much below the other two in the number of visitors and the celebrity of individual names.

Dr. Wichmann makes the following comparison :

Members.		Actually Present. about	
Paris (1875)	1488	French, 350 (?) Foreigners, 250	600
Venice (1881)	1099	Italian, 450 Foreigners, 330	780
Paris (1889)	530	French, 300 (?) Foreigners, 150	450 (?)
Berne (1891)	300 (?)	Swiss, 150 Foreigners, 150	300

The nationality of foreigners present at each Congress is shown in the following list:

	Paris, 1875.	Venice, 1881.	Paris, 1889.	Berne, 1891.
French.....	—	about 100	—	about 50
Italians.....	14	—	27	10
Swiss.....	9	14	12	—
Germans.....	57	50	5	30

	Paris, 1875.	Venice, 1881.	Paris, 1889.	Berne, 1891.
Austro-Hungarians	31	50	2	20
Romanians	?	?	12	1
Russians	37	20	13	10
Scandinavians	26	12	7	2
Netherlanders	13	8	9	2
Belgians	27	13	9	4
British	6	15	9	10
Spaniards	7	10	5	2
Portuguese	4	5	14	3
Oriental and Egyptian	8	16	6	2
Americans (North and South)	15	10	20	2
Australians	?	?	5	2
	about 250	330	150	140–150

The falling off in 1889 is attributed, in part, to the fact that the French celebrated in that year the Centenary of the Revolution, an event which did not appeal to the sympathies of every people; and the Berne Congress followed, as Dr. Wichmann thinks, too closely on that of Paris. He is undoubtedly right; and it may be believed that the interests of geography would not suffer if the International Congresses were separated by a fixed interval of six or seven years.

National Geographical Congresses are held in Germany (the ninth met in Vienna in 1891); in Switzerland (the eighth at Neuchâtel in 1890), and in France, where the twelfth Congress assembled at Rochefort, in 1891.

The Greatest Known Depths of the Sea.—The following table is taken from an article by Dr. Supan on "Deep-Sea Exploration in the years 1888–1890," in *Petermanns Mitteilungen, Band* 38, *II.* In the original the soundings are given in metres:

	Lat.	Long. (Greenwich.)	Depth.
N. Atlantic Ocean	19° 39′ N.	66° 26′ W.	27,366 feet.
S. Atlantic Ocean	0 11′ S.	18° 15′ "	24 180 "
North Sea (Skagerrak)	near 58° 12′ N.	9° 30′ E.	2,651 "
Baltic Sea	" 58° 37′ "	18° 30′ "	1,401 "

	Lat.	Long. (Greenwich).	Depth.
Mediterranean Sea	35° 45′ N.	21° 46′ E.	14,436 feet
Black Sea	near 42° 55′ "	33° 18′ "	8,589 "
Caribbean Sea	" 19° — "	81° 10′ W.	20,568 "
Indian Ocean	11° 22′ S.	116° 50′ E.	20,358 "
N. Pacific Ocean	44° 55′ N.	152° 26′ "	27,937 "
S. Pacific Ocean	17° 4′ S.	172° 14′ W.	27,179 "
Bering Sea	54° 30′ N.	175° 32′ "	12,881 "
Japan Sea	near 38° 30′ "	135° — E.	9 843 "
China Sea	" 17° 15′ "	118° 50′ "	14,101 "
Sulu Sea	8° 32′ "	121° 55′ "	15,299 "
Sea of Celebes	4° 16′ "	124° 2′ "	16,769 "
Banda Sea	5° 24′ S.	130° 37′ "	*16,798 "
Flores Sea	7° 43′ "	120° 26′ "	16,798 "
Arctic Ocean	78° 5′ N.	2° 30′ W.	15,899 "
Antarctic Ocean	62° 26′ S.	95° 44′ E.	11,851 "

EGLI'S NOMINA GEOGRAPHICA.†—The first edition of this book appeared in 1872, and it has been for twenty years the recognized authority on the derivation and explanation of geographical names, within the scope of its plan. This plan embraces the world, but the principles of selection followed throw out an immense number of names, which either explain themselves or find their proper place in special dictionaries or gazetteers. Many others are excluded for want of trustworthy evidence as to their origin; for Dr. Egli sifts his authorities and traces the history of each word with ample learning and unwearied patience. His study of this fascinating subject has covered a period of thirty-three years, and its results are fitly represented by the two editions of his work. The first explained 17,000 names, and comparatively few of these are found among the 42,000 of the new edition. Some articles, such as *Aa*, *Aachen*, *Abessinia*, *Amazonas*, have been rewritten; and

* Dr. Supan rejects, as doubtful, the depth of 7315 metres assigned to this sea by Berghaus and others.

† Nomina Geographica. Sprach-und Sacherklärung von 42,000 geographischen Namen aller Erdräume. Von Dr. J. J. Egli. Zweite, vermehrte und verbesserte Auflage. Leipzig, Friedrich Brandstetter, 1892.

the letter *A*, which filled 44 pages of the first edition, will now require very nearly 100 pages.

In the article on *America* Dr. Egli notices Mr. Marcou's* perverse fancy about the origin of the name, and its natural consequence in Mr. Lambert's Peruvian dream.

The *Nomina Geographica* is issued in parts, and will be completed this year.

THE SPELLING OF GEOGRAPHIC NAMES.—The first report of the U. S. Board on Geographic Names has been published as *Ex. Doc. No. 16, House of Representatives, 52d Congress, 1st Session.*

The report gives a corrected list of the names of counties in the United States, and an alphabetical list of the 2,000 decisions rendered. These decisions, most of which relate to American names, are accepted by the various Departments at Washington. The principles for special application in the United States are:

1. That spelling and pronunciation which is sanctioned by local usage should in general be adopted.

2. Where names have been changed or corrupted, and such changes or corruptions have become established by local usage, it is not in general advisable to attempt to restore the original form.

3. In cases where what was evidently originally the same word appears with various spellings sanctioned by local usage, when applied to different features, these various spellings should be regarded as in effect different names, and as a rule it is inadvisable to attempt to produce uniformity.

4. Where a choice is offered between two or more names for the same place or locality, all sanctioned by local usage, that which is most appropriate and euphonious should be adopted.

5. The possessive form should be avoided whenever it can be done without destroying the euphony of the name, or changing its descriptive application.

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* There is an error of date in the reference to the *Bulletin* of the Paris Geographical Society. Mr. Marcou's paper appeared, not in 1880, but in 1875; and a second article, the *Nouvelles Recherches*, continued the tale in 1888.

6. In names ending in "burgh," the final "h" should be dropped.

7. Names ending in "borough" should be abbreviated to "boro."

8. The word "center," as a part of a name, should be spelled as above and not "centre."

9. The use of hyphens in connecting parts of names should be discontinued.

10. The letters "C. H." (Court House) appended to the names of county seats should be omitted.

11. In the case of names consisting of more than one word, it is desirable to combine them into one word.

12. It is desirable to avoid the use of diacritic characters.

13. It is desirable to avoid the use of the words city and town as parts of names.

The system applied to names in foreign countries is almost identical with that adopted by the Council of the Royal Geographical Society in 1885, and published in the *Proceedings* for that year, pp. 535, 536. The broad principle there laid down was that "in writing geographical native names vowels should have their Italian significance and consonants that which they have in the English language." The detailed rules of this system, which contemplates only an approximation to the sound of the native names, were published in the *Proceedings* of the R. G. S. for February, 1892. It is there stated that the British Admiralty and War Office have used the system since 1885, that it has been accepted by the Foreign and Colonial Offices, and that the Colonies have been requested to adopt it in respect to names of native origin.

The systems followed by the French and the German Hydrographic Offices agree in the main with the English, and the influence of all these authorities works in the direction of uniformity.

It must, however, be admitted that the general practice in every country remains wholly unaffected by the example of reform. The Royal Geographical Society and the Board on Geographic Names write

Beirut, but English and American travellers ring the changes on *Beyroot*, *Beirout*, and *Beyrouth*, or insist upon the circumflex accent in the *rût*, which they erroneously suppose cannot then be mispronounced *rut*. The truth is that accents are a continual stumbling-block to the English printer and the English reader,* who will not learn their meaning and use. The scheme devised by the Royal Geographical Society does away with this cause of offence by retaining but one accent —the acute—to mark, where it is essential to mark, the syllable on which the stress falls in pronunciation; and the simplicity of all its rules may begin to be appreciated by the public before the twentieth century is far advanced.

It should be known that the Board on Geographic Names has to work at a disadvantage. The members receive no pay for their services; and the three Bulletins already issued could not have been printed without the help afforded by the Smithsonian Institution, the Coast and Geodetic Survey, and the Light House Board. This state of things reflects discredit on the Government.

THE GEOGRAPHICAL SOCIETY OF THE PACIFIC.—This Society, organized in March, 1881, has been known for eleven years as the worthy representative of geographical science on the Pacific coast. Its permanent control of the great work before it is now assured by its reor-

* In the first number of a work on Egypt (just published) by a member of several learned Societies, *Société* is printed *Sociètè*, and the name of Quatremère is twisted into Quaatêrmere.

ganization and incorporation in January last, with the following list of officers for the year 1892:

Organized March 16th, 1881. *Incorporated January 5th*, 1892.

THE GEOGRAPHICAL SOCIETY OF THE PACIFIC.

SAN FRANCISCO.

1892.

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THE CELEBRATION AT ASTORIA.—The people of Oregon and Washington commemorated with ceremonies and rejoicings, on May 10–12, the hundredth anniversary of Capt. Gray's discovery of the Columbia River.

There is, perhaps, more zeal than discretion in the prevailing desire to multiply centenaries, but the enthusiasm displayed at Astoria was called forth by an entirely worthy occasion.

Capt. Robert Gray was born in Tiverton, R. I., in 1755, and died in Charleston, S. C., in 1805. He first visited the north-west coast in 1787, in command of the *Washington*, accompanied by the *Columbia*, under Capt. Kendrick, both vessels having been fitted out by some Boston merchants. On this voyage Gray observed what he took to be the mouth of a great river near latitude 46°. The commanders exchanged ships and Gray sailed in the *Columbia* to Canton and thence homeward, in 1790, the first navigator to carry the American flag around the globe.

In 1791 he sailed again to the north-west coast in the *Columbia Redivıva*, and began his search for the river he had seen on his first voyage. On the 29th of April, 1792, he met Vancouver, who could not be persuaded that he had failed to notice the entrance to the river. Capt. Gray proceeded, and on the 11th of May made the discovery, which he recorded in his log-book, in the following words:

"May 11th.—At half past seven, we were out clear of the bars, and directed our course to the southward, along shore. At eight, P.M., the entrance of Bulfinch's Harbor bore north, distance four miles; the southern extremity of the land bore south-south-east, half east, and the northern north-north-west; sent up the main-top-gallant-yard and set all sail. At four, A.M., saw the entrance of our desired port bearing east-south-east, distance six leagues; in steering sails, and hauled our

wind in shore. At eight, A.M., being a little to windward of the entrance of the harbor, bore away, and run in east-north-east between the breakers, having from five to seven fathoms of water. When we were over the bar, we found this to be a large river of fresh water, up which we steered. Many canoes came alongside. At one, P.M., came to with the small bower, in ten fathoms, black and white sand. The entrance between the bars bore west-south-west, distant ten miles; the north side of the river a half mile distant from the ship; the south side of the same two and a half miles distance; a village on the north side of the river west by north, distant three-quarters of a mile. Vast numbers of natives came alongside; people employed in pumping the salt water out of our water-casks, in order to fill with fresh, while the ship floated in. So ends."

The river was named by Capt. Gray, and his own name is perpetuated in Gray's Harbor * on the coast of Washington.

JOHN MCLEAN.—Mr. David Boyle read before the Canadian Institute, of Toronto, in December, 1891, a paper (printed in the *Transactions* for April, 1892) on the discoverer of the Great Falls of Labrador. The paper was based on the manuscript journal of McLean, now in the possession of his son, Mr. Archibald McLean, of Buffalo.

John McLean was born in Argyleshire in 1797, or 1798, and entered the service of the Hudson Bay Company in the winter of 1820–21. He was sent from post to post, remaining at one place sometimes for a few

* Incorrectly spelled *Grey's Harbor* in Stielers Hand-atlas, 1891.

months, sometimes for years. It was in June, 1839, that he set out to discover, if possible, a river route between Ungava and the southern coast of Labrador; and about the middle of August he reached the Great Falls. His account of the discovery is very brief, as given in his *Twenty-five Years' Service in the Hudson's Bay Territory*, and according to Mr. Boyle the manuscript journal is almost identical with the printed volumes.

McLean is described as a man of high character and intelligence, well read in more than one language, and humane in his treatment of the natives, who regarded him as a friend.

He died at Victoria, British Columbia, March 5, 1890

FROUDE, AND THE U. S. SIGNAL SERVICE.—Mr. V. Freudenberg begins an article in *Ausland*, 1892, *No.* 16, *pp.* 244–246, with these words:

"The historian Froude, who resided in Jamaica during the years 1890 and 1891 as an official and observer of the United States Signal Service, expresses his conviction that nowhere else do such rainstorms occur as in Jamaica."*

Farther on two long passages are quoted from "Herr Froude": the first telling how a stream of water 6 inches thick poured on him while he was enjoying a bath in a pool; the second describing a tremendous rain that overtook him while out for a ride

*Der Historiker Froude, welcher sich als Beamter und Beobachter des United States Signal Service während der Jahre 1890 und 1891 in Jamaika aufhielt, spricht seine Ueberzeugung dahin aus, dass nirgend anderswo solche Regenstürme vorkommen, wie auf Jamaika.

on Hardware Gap. "Macintosh, umbrella, overshoes, etc," with which men ride on horseback, were of no more use than a mosquito-netting; the historian was wet to the skin, but he remembered what was due to the Signal Service, and found, on consulting his thermometer, that the temperature had fallen from 115° to 67° Fahrenheit.

Mr. Freudenberg writes with gravity and good faith, and his amusing legend, based upon Mr. Froude's visit to the West Indies, will furnish occupation to future biographers.

There was a station of the U. S. Signal Service at Kingston, Jamaica, during the years 1890 and 1891, and the name of the observer was Eugene M. Aaron.

Miss Amelia B. Edwards.—The London *Academy*, of May 21, has the following note:

"Miss Amelia B. Edwards has left almost the whole of her property to found a professorship of Egyptology, under certain conditions, at University College, London. We believe that the value of the chair will amount to about £400 a year."

The *Academy* quotes from the *Revue Critique* Prof. Maspero's tribute to Miss Edwards in these words:

"Sa bienveillance, sa bonne grâce, son empressement à louer les mémoires de nos débutants, lui avaient conquis rapidement l'affection de tous: il n'y a personne parmi nous à qui elle n'ait rendu service, plutôt dix fois qu'une. Ce n'est pas seulement un confrère que nous perdons, c'est une amie dévouée dont beaucoup d'entre nous ne retrouveront jamais la pareille."

THE LA REINTY PRIZE, 1894.—The *Académie des Sciences, Belles-Lettres et Arts de Rouen* offers a prize of 500 francs to the author of the best work, manuscript or in print, written in French, or the best work of art, illustrating the political and social history, the commerce, or the natural history of the Antilles, now in the possession of France or formerly held by her.

Each manuscript must bear a written motto, identical with one inscribed on a sealed envelope, which contains the name and residence of the author.

Works intended for competition are to be sent, carriage paid, before the 1st of May, 1894, to M. Barbier de la Serre, or to M. Pierre Le Verdier, Secretaries of the *Académie.*

THE FIRST ITALIAN GEOGRAPHICAL CONGRESS.—The following letter was received too late in the month of May for action by the Society:

ROME, April 20th, 1892.

The Italian Geographical Society has been authorized by the Municipality of Genoa to convoke a Geographical Congress to be held in that city, in commemoration of the IV. Centenary of the discovery of America.

No historical event is more deserving of celebration by Geographers throughout the world.

It was this idea that inspired the International Geographical Congress, held at Bern in 1891, when it decreed that to the commemoration in Genoa and in Spain, all Geographical Societies should be invited to send Delegates.

In consideration of these facts, I have the honor to

invite your illustrious Society, in the name of the Italian Geographical Society and also in the name of the Municipality of Genoa, to send one or several Representatives to the above-mentioned Congress.

The Congress will take place from the 18 to the 25 of next September.

The Delegates will be received with all due honor, and will be able, in conformity with our Regulations, to make communications and take part in the work of the Congress.

Other foreigners who, by their presence and erudition, may be willing to increase the splendor of the solemnity, will also be welcome.

In the meantime, we should be glad to know, within as brief a delay as convenient, the Names of your Delegates, which will enable us to forward in due time the programmes, circulars and every other necessary document, and we shall be greatly obliged by your communicating the contents of the present invitation to every member of your Society.

I have the honor to be yours obediently,

The President of the Italian Geographical Society, and of the Committee of the Congress,

MARQUIS GIACOMO DORIA, Senator.

GEOGRAPHY AT OXFORD AND CAMBRIDGE.—Mr. H. J. Mackinder, Reader in Geography at Oxford, reports to the Council of the Royal Geographical Society (*Proceedings*, June, 1892) that the attendance of graduates and undergraduates upon his lectures during the past year was: In Michaelmas Term, 33 from 8 colleges; in Hilary Term, 26 from 8 colleges; in the Summer

Term, 17 from 8 colleges. There were, in addition to these, 14 registered students of the Association for the Education of Women in Oxford, nearly all of whom attended throughout the year.

The lectures on physical geography were followed by two undergraduates. Four candidates presented themselves for the studentship in Geography, which was awarded to Mr. G. Brindoe Grundy, B.A., of Brasenose College. Mr. Grundy is preparing to do some work in Bœotia.

Mr. Mackinder delivered also sixty-eight lectures during the winter at various towns. In the spring he paid a visit to the United States, and was impressed by the geographical laboratories in charge of Prof. Davis at Harvard University.

Mr. J. Y. Buchanan, Lecturer in Geography at Cambridge, reports an attendance of from eight to twelve for the course, which covered the two terms. He also gave instruction in general geography to the two candidates for the Teachers' Examination.

Mr. Mackinder describes the prospects as bright, and to Mr. Buchanan they seem much more encouraging than they were.

The Observatory on Mont Blanc.—The Lucerne correspondent of the London *Times* announces in a letter dated June 8 that M. Jannssen persists in carrying out his plan for an observatory on the summit of Mont Blanc. The examination made last year proved that no rock existed for a foundation, and now it is determined to build on the solid snow. To test this, a wooden cabin was put up at the end of last summer.

It was visited in January and again in the spring, and was found to be uninjured.

The observatory building, now under construction in Paris, is eight metres long and four in width (26.25x 13.12 feet), and consists of two floors, each with two rooms. The lower floor is to be embedded in the snow, and the upper is the observatory. The roof, nearly flat, will be furnished with a balustrade and a cupola ; and the building will rest upon six jack-screws, to restore the equilibrium in case of need.

A thousand feet below the summit there will be a supplementary observatory.

It is hoped that the structure will be completed and in place, with the exception of the cupola, during the summer.

THE PONTINE MARSHES.—Capt. von Donat, in an address before the Berlin *Gesellschaft für Erdkunde*, on the 5 of March, described his observations in a visit to the Pontine Marshes, and formulated a plan for their reclamation.

His first stage took him from Rome to the vine-embowered Velletri, a charming little city, enthroned at an elevation of 1,300 feet on a volcanic hill on the southern slope of the Alban Mountains, adorned with stately churches and antique palaces, full of cheerful life and busy idleness, and, taken altogether or piece by piece, equally picturesque and—dirty.

Beyond Velletri, the 41 miles to Terracina were made on the top of the post-omnibus, a cyclopean vehicle, "comparable to Father Noah's ark." At Cisterna the Marshes begin, and the effect of the un-

wholesome air is seen in the suffering faces of the sallow, feeble-looking inhabitants. On the stretch of 32 miles between Cisterna and Terracina there are but thirty persons and those in the lonely post-stations.

This sparse and sickly population is in striking contrast with the fertility of the soil, the beauty of the site, and the exquisite climate.

From Cisterna the Via Appia runs through the entire length of the Marshes, which are about 23 miles long with a breadth of nearly 5 miles, and an area of not far from 125 square miles.*

This great extent of land, fruitful as it is beyond comparison with any other portion of Europe and only to be equalled in India, is absolutely unfit for habitation or for culture; while its poisonous exhalations carry death abroad over an additional surface of 340 square miles, so that

"More than 100,000 hectares (250,000 acres),—an area on which a population of half a million might live in plenty, from the neighborhood of Velletri on the north and westward to the gates of Rome, the classic ground of the last six books of the Æneid, Nettuno, Antium, Ardea—, are nothing but a green wilderness, with a few ruins and utterly lonely huts."

The broad, navigable canal of the Linea Pio flows beside the Via Appia as far as Ponte Maggiore, where

* A summary of Capt. von Donat's paper, printed in the *Proceedings* of the Royal Geographical Society for June, pp. 421–423, strangely belittles the Pontine Marshes and the extent of the region subject to their influence. It says: "These marshes extend in a narrow belt, from 1 to 1½ miles broad, and 5 miles long, from Cisterna at the foot of the Alban Hills to Terracina, at the southern foot of the Volscian Mountains. The marshes cover an area of about 6 square miles, but their poisonous exhalations carry death over another 16 square miles." . . .

The figures are those of Capt. von Donat, whose miles and square miles are German, not English. 1 German mile is equal to 4.61 English miles; 1 German square mile is equal to 21.26 English square miles. The author's measurements, though not meant to be precise, fairly represent the facts; and how can his 100,000 hectares be taken for the equivalent of 16, or 22, English square miles?

the sometimes unruly streams of the Volscian hills, the Amazeno and others, discharge, and send only about 1-20 of their united waters through the Canale di Terracina, much the larger part turning to the right and finding its way through the Portatore di Badino to the sea.

The Volscian hills, on the east of the Pontine basin, have an especial influence upon its condition. They are of limestone, split up and full of cavities, and are wholly denuded of soil, so that the bare yellow rocks stand out against the sky. The soil swept down from these hills by the torrents, united with the amazing vigor of the water vegetation and its decomposed masses, may well have filled up the Pontine gulf.

The streams that flow down from these hills are liable to extraordinary changes. The Amazeno, which usually carries 9 cubic metres (1,980 gallons) of water a second, becomes, after a heavy rainfall, a furious torrent with a volume of 80 cubic metres (17,600 gallons). The other streams contribute in proportion ; and those of the Alban Mountains, though more regular in their flow, take with them from those steeper heights a constant accession to the deposit in the Marshes. With all this accretion the level is perceptibly, though not greatly, raised above the sea. There are broad tracts, covering many thousand hectares, where the surface is under water to the depth of a metre for months at a time ; and yet the whole basin would become dry of itself but for the constant inflow from the sources named, and one other. The conditions prove this, with the elevation of the surface 1 metre above the sea, and an additional rise of 7 centimetres (nearly 3 inches) for

every kilometre inland. Only about 1,000 hectares (2,500 acres) lie so low that there would be no fall to carry off the water; and this extent of surface might well be doubled in the process of drying and by the shrinking of the peat beds, which form the surface of the Marshes. This layer of peat, which is 3 metres (nearly 10 feet) in thickness at the Via Appia, increases towards the Volscian hills, where it reaches a depth of 22 metres (72 feet).

Besides the mountain streams already mentioned, there lies along the base of the Volscian hills another source of water supply in the springs that gush out, the Fiume Coperto, the Ninfa, the Cavata, and Horace's Feronia. A scientific calculation shows that these springs deliver ½ times as much water as could properly discharge itself from the whole Pontine watershed.

Capt. von Donat briefly reviews the history of the attempts to drain the Pontine Marshes, from the time of Appius Claudius to that of Pope Pius VI., and the survey made by Prony, under Napoleon I. This survey is declared to be so thorough that a study of it gives a knowledge of the Marshes, as complete as any that could be gained in a year's residence on the spot.

Capt. von Donat's own plan contemplates a radical cure. No stream, not even a drop of water, must be allowed to flow into the Marshes. All inflow must be intercepted by peripheral canals, and carried directly to the sea. This could be done very easily on the west, where the Sisto is as good as ready, needing only to have a canal 600 metres (2,000 feet) long cut through. On the left side of the Marshes the task would be

harder, where the Uffente, the Amazeno and the Pedicata would require to be shut off and to be conducted along the line of the road to Terracina.

Measures would be necessary to control the flow of the water from the Volscian hills so that the floods, which now pour out in 2½ days, would take four days to spend themselves, and the 80 cubic metres (17,600 gallons) of the Amazeno would be reduced to 50 cubic metres (11,000 gallons) a second. This could be effected :

(*a*) By encouraging the growth of plants, such as the cactus.

(*b*) By establishing a great many small funnels in the upper mountain regions and especially in the channels of the water-courses, so that the rain water should be collected and slowly passed through them.

(*c*) By larger dams.

By far the largest part of the now inundated district would free itself of water within a few weeks, if the supply from without were cut off by the means proposed.

The 2,000 low-lying hectares (5,000 acres) would be shut off from the rest of the Marsh region by small closed dams and provided with a special system of channels, and most of all with a single drain channel, or sluice, opening outwards and closing of itself with the return flood ; for the tide is felt in the canals for a distance of 8 kilometres (5 miles). The lower half of these 5,000 acres would be freed by pumping.

These operations could be carried through, Capt. von Donat says, on the outer edge of the Marshes, and therefore with the least possible danger to health for

the workmen, and completed in a single winter, if begun simultaneously at all points, at a cost of less than 1,000,000 lire ($200,000).

MERCURY AND PLATINUM IN RUSSIA.—Prof. E Muller, of Tashkent, contributes to the *Comptes Rendus* of the Paris Geographical Society, for April 22, a memorandum on the production of these metals in Russia.

Some deposits of mercury have been found in the Caucasus, but the establishment in the Bakhmutski district, in the government of Ekaterinoslav, founded within the last ten years, monopolizes the production, which amounts to more than 20,000 puds (720,000 pounds) of pure metal. This is furnished at so low a cost that Russia exports, after supplying her own demand, more than 500,000 pounds.

Platinum is found in the Ural Mountains, on both slopes. The mines of the Bisserski district, in the government of Perm, are the richest, and, as Prof. Muller remarks, might supply the demand of the whole world. It is only in the Ural that platinum is found in the form of grains, in beds of sand, often, but not always, containing gold. Some of the beds are covered by peat, of six or seven feet in thickness; others lie at a depth of from 30 to 45 feet; but the metal-bearing sand is of a nearly constant thickness of from 3 or 4 to 7 feet.

The beds in the north (the Bisserski and others) contain a good deal of gold, and the platinum is clear and brilliant, while in the Taghil district, on the western slope, the platinum is dark and is often found in association with iridium and osmium. The size of the

grains is about the same in both localities, and the metal is rarely found in the form of nuggets; when it is, the pieces weigh but a few pounds. In 1887, two nuggets were found in the Bisserski mines, one weighing a little more than a pound, the other about five pounds; and one nearly as heavy as the second was found in 1889, shaped like a horseshoe.

The annual production for the past twelve years has been about 7,050 pounds, and the consumption of the world is estimated by Prof. Muller at something more than 7,200 pounds.

As recently as the year 1860, when platinum was in small demand, the little grains were often used by those who found them for bird shot.

The platinum collected in the Ural mines is sent to St. Petersburg and goes thence almost exclusively to London, where it is quoted at the Exchange according to the quantity held by the Bank. It is only since 1886 that the price has exceeded 3,000 rubles a pud ($2,310 for 36 pounds). In 1890 the price rose to 12,000 rubles.

FU-SANG.*—In this pamphlet of sixty-eight pages, Mr. Schlegel offers the result of his studies on the supposed discovery of America by the Chinese, at an early period.

It was about the middle of the eighteenth century that M. de Guignes announced to the *Académie des Inscriptions et Belles-Lettres* that he had found in the an-

* Problèmes Géographiques—Les Peuples Étrangers chez les Historiens Chinois —Fou-sang Kouo. Le Pays de Fou-sang. Par Gustave Schlegel, Professeur de Langue et de Littérature chinoises à l'Université de Leide. (Leide, E. J. Brill, 1892.)

cient Chinese historians the statement that some Buddhist priests had discovered, in the fifth century, a country called Fu-sang, which he believed to be the western coast of America, and, more particularly, Mexico.

De Guignes's argument has been supported by Carl Friedrich Neumann (1841), Gustave d'Eichthal (1865), and Charles G. Leland (1875). It was vigorously attacked in 1834 by the orientalist Julius Heinrich Klaproth; but neither he nor the other writers who have taken sides on the question, can be said to have done more than to reaffirm or to deny the original supposition.*

According to Mr. Schlegel, it is only for Europeans that Fu-sang can be called an unknown country. Among the Chinese, it is supposed to be as well known as Japan or Formosa.

It figures in its place on the old Chinese maps (anterior to the arrival of the Jesuits) and Mr. Schlegel identifies it with the island of *Krafto*, *Krapto* or *Karafuto*, the *Saghalien* † of European maps.

* Mr. Schlegel adds in a note that *Krafto* was unknown in Europe till the maps constructed by the Jesuit Fathers in the reign of K'ang-hi came into the hands of D'Anville, who reproduced them in Du Halde's China and in the *Nouvel Atlas de la Chine* (1737). On the map, the island of Krafto, opposite the mouth of the Amur river, bore no name; but just at the mouth of the river were the Manchu words, *Saghalien anga hada*, signifying *Rocks of the black mouth;* a number of islets. The Manchu word for *island* is *tun*. Those who copied D'Anville's map kept only the word *Saghalien*, and applied it to the large island.

† Dr. S. Wells Williams, in a paper read before the American Oriental Society in October, 1880, admitted the probable identity of Fu-sang with Saghalien. He held two arguments, both derived from the report of Hwui-shin (Mr. Schlegel's Hoeï-chin), to be decisive against America:

(1) That the manufacture of *kin*, or brocade, from the bark of the Fu-sang tree is unknown outside of Saghalien;

(2) That the reference to the variation in the colors of the king's robes and the ten cyclic years shows that the people of Fu-sang knew and adopted the sexagenary (or Chinese) cycle for computing time and periods; while no such scheme is known to have existed among any people on the American Continent.

The Chinese writers indulge freely their taste for the marvellous and the extravagant, and their figures, whether for numbers or for distances, are not to be trusted. In examining their accounts of Fu-sang, Mr. Schlegel takes the geographical position of the country, its products, the description of the people, and their relations with China and with other countries.

Fu-sang is the country where the sun rises. All the authors speak of the tree Fu-sang, from the bark of which cloth and paper are made. Fu-sang produces, it is said, silk worms that make a yellow silk, which they attach to the branches of trees without spinning a cocoon. Among the fruits of Fu-sang there are red pears or apples, and grapes. Red gold is one of the minerals, and copper is found, but there is no iron, and the people value this metal more than gold or silver. One Chinese author mentions the "round precious stones" of Fu-sang, and a tribute sent from that country, A.D. 502–519, included a "precious stone with which to look at the sun." Hoeï-chin says that the oxen (probably reindeer) of Fu-sang have very large horns, and that the inhabitants raise deer as cattle are raised in China, and make quass of their milk. There are horses also in Fu-sang.

All these notices apply to the island of Saghalien.

Mr. Schlegel shows also that the descriptions of the people of Fu-sang, their habitations and customs, their government and administration, agree with the accounts of the Aïnos in Saghalien given by La Pérouse, the Dutch voyagers, Von Siebold and others. According to Hoeï-chin, the people of Fu-sang were acquainted with the art of writing, and this is unknown among the

modern Aïnos. Their traditions affirm, however, that in the 12th century of our era the Japanese hero Yochi-tsune possessed himself of the treasures and the *books* of the Aïnos, which he carried off; and from that time the Aïnos lost the arts of writing and of pottery.

Tung-fang soh is the only Chinese writer who gives anything like a reasonable idea as to the geographical position of Fu-sang. It lies, according to him, on the eastern coast of the Eastern Sea (Sea of Japan). Following the coast of China, from Korea northward, the Eastern Sea is on the right hand, and at the extremity of this sea, 10,000 *li* * distant, is Fu-sang, necessarily an island, for it is said to be in the sea.

A conclusive argument against the identification of Fu-sang with America is found in a passage of Sze-ma, who declares that the Kuro Siwo is to the eastward of Fu-sang, and Tch' in Lunkiung writes, in his geography: "East of Japan and the Liu-kiu (islands), the waters all flow towards the east, and this is what Tchoang-tsze means when he says that the *Mi-lü* (the Chinese name of the Kuro Siwo) bears them away."

Mr. Schlegel quotes in every instance the Chinese text on which he relies for a statement, and his criticism seems to dispose of one venerable delusion; but delusions die hard.

THE KOREAN REPOSITORY.—This monthly magazine is published at Seoul, and "mailed by the last steamer from Chemulpo"; but Nos. 2 (February) and 4

* The Chinese *li* is a little more than a third of a mile; but the ancient *li* was shorter than the modern.

(April) are all that have come to hand. These contain some sketches of travel, two articles on the Japanese invasion in the 16th century, the notice of the discovery of a triumphal monument erected 650 A.D., and a discussion of the question: "What is the Population of Korea?" Mr. Appenzeller is inclined to think that the kingdom may contain 7,200,000 persons; *A Subscriber* computes 80,000 villages for the whole country, with 100 or 150 persons to a village, and a total of 8,000,000 or 12,000,000; Mr. Jas. S. Gale, considering the ruinous state of all official institutions in Korea for the last half century, judges that the record of fifty years ago may serve for to-day, since the indications are that the population does not increase; and Père Dallet then wrote that perhaps 10,000,000—an average, that is, of six persons to a house—would not be far from the truth.

A March across Tibet.—The London *Times* of April 26 publishes the report of a remarkable journey across Tibet, just accomplished by Capt. Bower, of the Indian Staff Corps. Capt. Bower had with him Dr. Thorold, a sub-surveyor, a Pathan orderly, a Hindustani cook, 6 caravan drivers, and 47 ponies and mules.

The start was made from Leh, June 14, and the Lanak Pass was crossed July 3. Thence the march due east led past a chain of salt lakes, one of which, Hor-Ba-Too, is at an elevation of 17,930 feet. In E. Long. 83°, N. Lat. 35°, a magnificent snowy range was seen, with a lofty peak.

For many weeks the journey was over table-lands 15,000 feet in height. There were no inhabitants, and

water was scarce. September 3, the party arrived at Gya-Kiu-Linchin on the north shore of the Tengri Nor. Here two officials from the governor of Lhasa peremptorily ordered Capt. Bower to go back. This he refused to do, and, after a parley, guides were furnished to lead him by a detour to the north to the frontier of Western China. He reached Chiamdo, December 31, having followed Bonvalot's route for some distance. Chiamdo is in a fertile, well-wooded country. The town is full of monks, who made threats against the travellers, but were held in awe by the breech-loaders.

Capt. Bower had intended to make his way to Upper Burma, but the Tibetans reported that 200 Europeans were at Tarchindo (Ta-tsien), and he proceeded thither, arriving on the 10th of February. Eight marches beyond brought him to a tributary of the Yang-tse-Kiang, and the rest of the journey was made by boat to Shanghai, which was reached March 29.

From Lanakma to Tarchindo the distance was over 2,000 miles, nearly all through a wholly unexplored country. Some of the marches were 30 miles long, and for 13 consecutive days the route was over a table-land, more than 17,000 feet above the sea.

Capt. Bower is engaged in writing his report.

A Recovery in Ashango-Land.—A letter from West Africa, printed in the New York *Sun*, of May 22, tells the following story concerning the baggage lost by the explorer, Paul B. Du Chaillu, during his running fight with the Ashangos.

The letter says: "These goods have never been disturbed. The natives, on going to the place where the

goods were dropped, say that some of the boxes began to talk. They doubtless referred to one of the music-boxes which were among Du Chaillu's presents for the native chiefs. In lifting a box containing one of these musical instruments it is likely that the music began to play, scaring the natives half to death. They decided that all the property of the white man was fetich, and that they and all their people would perish if they touched any of the goods, so everything was left just as it had fallen. . . . I, however, have taken away some of these interesting relics. One of them is a box containing a large magnet for polarizing the compasses. Another is a box containing a large number of English and French scientific periodicals. Mr. Townsend took away as a relic the inside of a musical box. I shall bring the relics back home to show that I have been on the ground where Du Chaillu sustained his severe defeat."

Mr. Du Chaillu's account of the fight and the retreat is given in Chapters XVII and XVIII of his *Journey to Ashango-Land.*

From Karagwe to the Albert-Edward Lake.—Dr. von Danckelman publishes, in the *Mittheilungen von Forschungsreisenden, u.s.w., V. Band, 2 Heft*, some remarks on a sketch-map received from Dr. Stuhlmann, who accompanied Emin Pasha in his march to his old province. The map was communicated by Dr. Stuhlmann's father, who received with it a letter written on the 12th May, 1891, from Vitshumbi at the S. W. end of the Ngezi (Albert Edward) Lake. The letter describes the route :

"From Kafuro in a N. N. W. direction to Kavingo in Iwanda, thence to the W. and W. N. W. through Mpororo and Butumbi to this place. The route very mountainous, even 2,100 metres (6,890 feet) in height close to the lake, and mountains quite as high on the other side of it. The Mfumbiro (mountain) lies in 1° 19′ S. Lat., and about 31° 4′* E. Long. W. S. W. of it a complete chain of six volcanic peaks, one of which, Kissigali, is immensely steep and fully 4,000 to 4,500 metres (13,124 to 14,764 feet) in height. The most westerly, Virungo, is still active.

"While a strong Wahuma population holds Mpororo and Butumbi, there are more of the Wakonjo in this place. From Karagwe to Mpororo, and for the most part also in Butumbi, the elevations are bare, grassy hills of schist, with occasional outcroppings of granite. Their direction is from S. W. to N. E. The mountains, 2,100 metres (6,890 feet) high on the margin of the lake, are wooded, with heaths above, and below the West African forest, with gray parrots, chimpanzees, etc.

"The lake, which is at an elevation of 840 metres (2,756 feet), and not, as Stanley writes, of 1,008 metres (3,307 feet), had once a much greater extension towards the south, as appears from the sub-fossil shells. Sixty years ago it must have reached the Bustue mountains, which lie three hours' march to the S. W. The river Rutsdúrra, from Ruhanda, enters the southern end of the lake with a breadth of 50 metres (164 feet).

"I have reason to be well satisfied with the geo-

* The figures in the *Mittheilungen* are "etwa 13° 4′ östlicher Länge"; an unlucky transposition.

graphical results. The route has been laid down by continual measurements, by astronomical determinations, and by aneroid-readings, and many new discoveries have been made."

Dr. von Danckelman adds in a note that the name of the river (Rutsdúrra) is not clear in Dr. Stuhlmann's manuscript, and that Rutschurra is perhaps the true name.

In *Petermanns Mitteilungen*, 38 Band, V, p. 126, Dr. H. Wichmann says: "If the latest telegraphic news is confirmed, the darkness which covers Emin Pasha's position begins to lighten. This telegram states that Dr. Stuhlmann returned on the 15th February to the station Bukoba on the western shore of the Victoria Nyanza, and that Emin was following slowly, kept back by sickness. According to the report of August, 1891, Emin, after crossing the Albert Edward lake, had gone towards the north, apparently with the intention of recovering his abandoned province. This latest telegram seems to show that he has not got so far, but has been compelled to return on account of the famine prevailing in Undussuma, a district about 50 kilometres (31 miles) to the W. of the southern end of the Albert Nyanza, where Stanley fought the Wasamboni. It is not explained in the telegram why Emin made so great a circuit to the west, nor why he did not pass round the famine-stricken region by another way, such, for instance, as the voyage across the lake."

The later report of Emin's death must be received with caution.

Mr. L. Dècle on the Upper Zambezi.—A letter from Mr. Dècle, dated at "Palapye (Mangwato), capi-

tal of King Khama, chief of the Bamangwatos, 20 January, 1892," is published in No. 6 of the *Comptes Rendus* of the Paris Geographical Society.

In this letter the traveller says that he set out with 18 porters, on the 6th of December, for the Victoria Falls. The route generally taken lies on the left, or north, bank of the river. In order to examine the rapids between Kazungula and the Falls, Mr. Dècle followed the right bank of the river, and encountered many obstacles. He struggled sometimes through canebrakes, where the canes grew more than ten feet high, and he sank knee-deep in the marshy soil; sometimes through dense forests or tall grasses; and the rain poured steadily for the six days and nights of the march. There were antelopes everywhere, and the tracks of lions; and the river was full of hippopotami, especially about the rapids.

"At last," he says, "I reached the Falls. I frankly confess that I hardly know what to say of them. All those who have seen them have been so enthusiastic that I do not dare to utter my opinion, and shall therefore content myself with saying that the Falls would be imposing—if one could only see something of them. The entire river, nearly a kilometre and a half (almost a mile) in width, disappeared in the bowels of the earth, falling from a height which I estimate at 120 metres (394 feet) into a gorge less than 150 metres (492 feet) in breadth. The water is dashed upon the bottom of this gorge with such violence that it is thrown back again 100 metres (328 feet) above the river. The column of vapour is visible 10 kilometres (6 miles) away, and the roar of the Falls is heard at a considerable distance.

"It follows that on the other side of the gorge you are covered with sheets of water and find it impossible to make out the bottom. From one point alone you can see nearly 200 metres (656 feet) of the Falls at their full elevation. The impression that remains with you is like that which you feel after looking on at a great surgical operation; you are possessed by it, and you shudder. As for comparing the Victoria Falls with Niagara, that is impossible; the latter are imposing, the former are terrifying, more by what is imagined of them than by what is seen."

At the Falls Mr. Dècle was taken with the fever. As soon as he could travel, he turned to the south, and arrived in three days at Pandamatenga, where he expected to find grain; but the crops had failed, and he was obliged to move on. He was again attacked by the fever, which delayed him a week, and at last (Dec. 31) he reached Nata, in the Kalahari Desert, in a very weak state. He had just made up his mind to kill one of the two beasts he had (an ass), when some natives arrived, escorting one of King Khama's ambassadors. With their help he reached his camp on the 6th of January, and Palapye on the 18th. Two men were lost on this expedition. They were laggards, who did not keep up with the rest, and perished of hunger in the desert.

TITLES OF PAPERS IN GEOGRAPHICAL JOURNALS.

BERLIN.—*Verhandlungen der Gesellschaft für Erdkunde.*

Unveiling of the Monument to Gustav Nachtigal, February 23, 1892—Japanese Commerce (Dr. K. Rathgen)—The Vegetation of New Guinea

(Dr. O. Warburg)—First and Second Reports of Dr. G. Schott upon his Voyage in Eastern-Asiatic Waters—The Pontine Marshes (Capt. von Donat).

Zeitschrift.

Peter Sparnau and Ulrich von Tennstaedt's Pilgrimage to Jerusalem in 1385 (Reinhold Röhricht)—The First Expedition to take formal Possession of the Philippines (Eugen Gelcich)—The Elastic Recovery in Aneroids on High Mountains (Dr. A. von Danckelman)—Supplement to the Paper on the Geographical Extension of the Mammalia in the Black-Earth Region (Prof. Dr. A. Nehring)—An Answer to Hermann Wagner's Remarks on Anthropogeography (2d Article) by Friedrich Ratzel.

EDINBURGH.—*The Scottish Geographical Magazine.*

Japanese Characteristics. By Prof. C. G. Knott, D.Sc., etc.—Deep-Sea Deposits. By W. E. Hoyle, M.A.—Progress of the Indian Surveys, 1875 to 1890. By Colonel James Sconce—The Yellowstone Region and Its Geysers. By Henry M. Cadell, of Grange, B.Sc., etc.—The Meteorology of India and the Surrounding Sea-Areas. By H. N. Dickson, F.R.S.E., etc.—The Pygmy Tribes of Africa. By Dr. Henry Schlichter—The New Hebrideans. By the Rev. James H. Lawrie, of Aneityum—The Russian Kurds. By W. A. Taylor, M.A., F.R.S.E.

GOTHA.—*Petermanns Mitteilungen.*

The Island of Rotti (South of Timor), by Prof.

Dr. A. Wichmann—The Lake of Caldonazzo and Levico (Tyrol), by Prof. J. Damian—Contributions to the Knowledge of South-Eastern Persia (A. J. Ceyp)—The Mean Level of the European Seas (Prof. Dr. A. Supan).

LISBON.—*Boletim da Sociedade de Geographia.*

The Dominion of Portugal on the African Continent—Our Geodetic Labours—Lights and Buoys—Cabo Verde—Cabinda and Emigration—Sofala—The elevated Plain of Caconda and the Basin of the Lubango, considered with regard to European Colonization and the Cultivation of the Soil.

LONDON.—*Royal Geographical Society, Proceedings.*

Journeys in the Pamirs and the Adjacent Countries. By Capt. F. E. Younghusband, C.I.E. —Obituary: Henry Walter Bates, F.R.S.; Sir John Coode, G.C.M.G., F.R.G.S.—The Ruins of Mashonaland (Illustrated). By J. Theodore Bent, Esq.—The Geography and Meteorology of Mashonaland. By R. M. W. Swan, Esq.—List of Stations in Mashonaland. By R. M. W. Swan, Esq.—The Orientation of the Buildings at Zimbabwe. By R. M. W. Swan, Esq.—Discovery of the Galápagos Islands. By Clements R. Markham, Esq., C.B., F.R.S.—The New Lake in California. By Jacques W. Redway, Esq.—The Annual Address on the Progress of Geography: 1891–92. By the Right Hon. Sir Mountstuart E. Grant Duff, G.C.S.I.,

President—The Indian Surveys, 1890–91—A Recent Journey to the Headwaters of the Ucayali, Central Peru. By Alexander Ross, Esq. With Discussion—Geographical Education: The Year's Progress at Oxford and Cambridge. By H. J. Mackinder, Esq., and J. Y. Buchanan, Esq.—The Late Professor E. A. Freeman and His Services to Geography. By C. R. M.—Direct Communication between Upper Assam and Northern Burma—Obituary: General Sir Lewis Pelly, K.C.B., K.C.S.I., M.P.

MADRID.—*Sociedad Geográfica de, Boletín.*

Report on the Condition of the Society. By D. Adolfo de Motta—Report on Geographical Progress. By D. Martín Ferreiro—Gibraltar. By D. Luís García Martín—Problems of the Mediterranean. By D. Rafael Torres Campos—The Moors (natives) of the Philippines. By D. Fernando Blumentritt—Authentic Notices of the Famous River Marañon. By D. Marcos Jiménez de la Espada—The Island of Fernando Póo. By D. José Valero y Belenguer.

PARIS.—*Société de Géographie. Comptes Rendus.*

M. Léon Fabert on the Trarza Moors and the Southwestern Sahara—M. Rolland on the Subterranean Waters in the Upper Sahara of Alger, between Laghouat and El Goléa—The Geography of the Vosges—The Russian Railways—The Touaregs—M. Dècle on the Upper Zambezi—The Population of Eng-

land in the Nineteenth Century—Finnish Explorations in Northern Russia—Dr. Ten Kate in Oceania—Subterranean Explorations in France (M. Martel)—Production of Mercury and Platinum in Russia (Prof. E. Muller)—The Lepers of Bokhara—Population of Canada—The Malay Peninsula—The Mekong River—Measurement of Altitudes and the Level of the Sea.

ROME.—*Società Geografica Italiana, Bollettino.*

Travels among the Independent Bataks (E. Modigliani)—The Zoological Collections of the Bricchetti-Robecchi Expedition—Earthquake and Submarine Eruption at Pantelleria in the latter part of October, 1891 (A. Riccò)—The Size and Position of Sicily according to certain Greek Geographers (G. M. Columba)—China and Foreign Nations (U. Ojetti)—Unpublished Letter of Charles V to Cortés: Communicated by P. Peragallo—The Hydrographic Expedition of the *Scilla* in the Red Sea: a letter from her commander, G. Casanello—The First Crossing of the Somali Peninsula (Bricchetti-Robecchi)—Mountains in Modern Geography (F. Porena)—From Covendo to Reyes (L. Balzan)—Dr. Schweinfurth and Eritrea—An Abyssinian Interview in the Sixteenth Century—Prof. Marinelli's Universal Geography—Dr. Ganzenmüller's Explanation of Geographical Names.

TURIN.—*Cosmos.*

The Aru Islands (Western New Guinea). By

Prof. Guido Cora—Hydrographic Charts of the Swiss Lakes. By Prof. Dr. F. A. Forel—The Metric Value of the Degree of the Meridian, according to the Arab Geographers (C. A. Nallino).

WASHINGTON.—*The National Geographic Magazine.*

An Expedition through the Yukon District (Charles Willard Hayes).

WASHINGTON LETTER.

WASHINGTON, June 20, 1892.

THE GULF STREAM.—The Coast Survey recently issued Lieut. J. E. Pillsbury's researches on the Gulf Stream.* The paper contains a résumé of the world's knowledge of this subject, but is intended also to explain in detail recent advances, made possible by devices for taking observations from fixed points within the current of the stream, and for anchoring vessels in deep sea. Heretofore all the theories as to causes, and all the facts as to limits, velocity and direction, have been based entirely upon drift of vessels, or inferences drawn from temperature observations, character of the bottom soil, presence of gulf weed, tide rips, etc., the best of them only giving evidence of the existence of a current when it is strong, and not one of them giving anything conclusive or accurate as to velocity or direction, or an indication even of a regular variation, either daily or monthly.

Prof. Hilgard first attacked the problem and authorized the attempt to anchor off Jupiter Inlet. Lieut. J. C. Fremont, Jr., was detailed for the first investigation to be made from a vessel at anchor. He occupied five stations across the channel, the deepest anchorage

* Appendix No. 10, Report for 1890. Washington, 1891. 4to, 162 pp., 24 plates.

being over 400 fathoms. This was in 1883–84. A few years later Lieut. Pillsbury occupied numerous stations, the deepest anchorage being 2,180 fathoms. The observations of Lieut. Fremont proved that the attempt to establish the axis of the stream by the thermometer was an error. It has since been found that a current may be flowing south with a much warmer temperature than when, a few hours later, it is flowing north. Lieut. Pillsbury demonstrates that while a warm current may be flowing in its customary place, its warm water may be transmitted by the wind and waves to other localities, without an accompanying current.

The Gulf Stream, which Lieut. Pillsbury characterizes as the grandest and most mighty of any terrestrial phenomena,—a great ocean river characterized by a deep blue color, great clearness, and high temperature, "receives its waters," he says, "from the Atlantic, partly by means of a current driven by the force of the south-east trade-winds along the north-east coast of South America, and partly, by a current from the north-east trade-winds. The water, as a current, flows only through the passages between the Windward Islands, and not through the Anegada, Mona, or Windward Passages. All the water entering the Caribbean as described does not flow the length of that sea as a current, but a portion of it returns to the eastward through the passages, usually as a subcurrent. In addition, there is a large body of water thrown by the waves into the Caribbean through all the passages. The current found along the South American coast, between Trinidad and Curaçao, is chiefly produced by the escape of water thrown there by the waves, no large body per-

manently entering the sea through the passage south of Grenada. The flow of water across the Caribbean is of the same character as that found outside the islands, a scarcely perceptible current on the surface at first, but increasing in its velocity as the longitude increases. The water accumulated in the western Caribbean escapes into the Gulf of Mexico."

A brief review of theories concerning the Gulf Stream, in chronological periods, gathered and largely quoted from Lieut. Pillsbury's studies, will not be uninteresting.

In actual observations of the currents contributing to the Gulf Stream, Columbus was the pioneer. Lieut. Pillsbury advanced the happy thought on the eve of this quadri-centennial that it is probable that to the Gulf Stream in part the world owes the discovery of America. I quote: "Columbus, before undertaking his voyage of discovery toward the west, resided for some time on the island of Porto Santo, and it was here that he was shown a piece of curiously carved wood that had evidently drifted there from other lands. Strange woods and other floating objects were continually being thrown upon the shores of Norway, Scotland and Ireland, all of which, to a thoughtful mind like that of Columbus, must have induced the belief that there were other lands at no great distance to the west."

Columbus, in his voyages, made frequent soundings with deep-sea lines, and remarked the strong currents of the Caribbean Sea. Speculating on the cause, he thought "that the equatorial waters followed the motions of the heavens about the world—that is, the

rotary motion by which the stars and air revolve about the globe (as was the opinion of the time), so also the water was supposed to partake of the same motion."

Peter Martyr, in 1515, and later, narrates the views of Andreas Moralis* and Ouidas;† and it is remarkable that they were so near the truth, considering how imperfect was their knowledge of the form or extent of the continent. For the next 65 years there was gradual extension of knowledge on the subject of ocean currents. About 1578 appeared the theory in "La Cosmographie," that the currents in the Straits of Florida were caused by the rivers emptying into the Gulf of Mexico. Nearly seventy-five years later (in 1650) Varenius gave the most complete description of currents which had been issued up to his time. The system of which the Gulf Stream forms a part he placed in a perpetual special motion of the sea, and describes it as a gigantic stream, beginning at the eastern capes of Brazil, flowing from south to north and ending toward Florida. Isaac Vossius, in 1663, ascribed the cause of the ocean circulation to the heats of the tropical sun attracting the ocean and at the same time increasing its bulk, forming, as it were, a long mountain of water. He concluded that the sun carried this mountain of water toward the South American shore, where it broke, and ran along the coasts. A French hydrographer, Fournier, some years later, propounded a theory almost the opposite. It was that the sun evaporated enough water in the tropics to make a deep valley, and therefore the water from the poles was forced to run towards the equator along the coast of Africa to replace the lost water.

* Morales. † Oviedo.

The first published chart, showing the system of ocean circulation and the Gulf Stream, was given to the world in 1678 by Athanasius Kircher in his "Mundus Subterraneus"; and in 1685 Happelius published a chart of ocean currents, quite similar to Kircher's, in "Relationes Curiosæ." Both these charts are reproduced in Lieut. Pillsbury's paper.

For the next one hundred years no new theories were advanced. "The coasting captains and whalers, however, were gaining experience regarding the stream, and to the latter, more than all others up to the time of the Revolutionary War, Franklin was indebted for the information which led to the publication of his chart of the great ocean current." He gives his own account of his acquaintance with the peculiarities of the Gulf Stream, which he had obtained largely from a sea captain. The English sea captains, however, rejected his chart, which for political reasons he thereafter suppressed for a time. Franklin's theory of the Gulf Stream, in his own words, is: "This stream is probably generated by the great accumulation of water on the eastern coast of America, between the tropics, by the trade-winds which constantly blow there. It is known that a large piece of water, 10 miles broad and generally only three feet deep, has, by a strong wind, had its water driven to one side and sustained, so as to become six feet deep, while the windward side was laid dry. This may give some idea of the quantity heaped upon the American coast, and the reason of its running down in a strong current through the islands into the Bay of Mexico, and from thence proceeding along the coasts and banks of Newfoundland, where it

turns off towards, and runs through, the Western Islands."

Contemporaneous with Franklin in investigating the phenomena of the stream, was Dr. Charles Blagden, of the Royal Army. These men were the first two to demonstrate the usefulness of the thermometer in their investigations. Col. Jonathan Williams, a nephew of Franklin, accompanied him on one of his voyages, and continued the thermometer experiments begun by his uncle. He published a work in 1799 on Thermometrical Navigation, which contained a chart of the Gulf Stream and the temperature of the water on adjacent banks.

From the time of Franklin and Blagden, for more than a century, all the investigation of ocean currents was based solely upon the thermometer and chronometer, and upon what in effect is the same as the latter, the drift of bottles.

Humboldt, in 1814, published a valuable description of the Gulf Stream, the result of his own observations. His theory was, that its force and direction depended, to a large extent, upon the changes in the trade-winds, and also, that the general torpidity of the ice in the Arctic in the winter, and its melting in the summer, influenced it. As to the direction of currents, he says: "Considering the velocity of the fluid elements which, in different latitudes, in consequence of the earth's rotation, is different, one should be tempted to think that every current from south to north ought to have at the same time a tendency to the east, and a current from the north to the south a tendency to the west." He published a chart of the Gulf Stream.

Capt. Scoresby investigated the northern extension of the stream, and discovered in the vicinity of Spitzbergen that an under stratum of water was generally warmer than at the surface.

Col. E. Sabine, a member of an expedition organized in 1822 to determine the figure of the earth, observed on ocean temperatures that he found in the Eastern Atlantic a body of water very much warmer than normal, and attributed this fact to an unusual elevation of the Gulf of Mexico and the Caribbean, due to abnormally strong trade-winds.

In 1832 the daughter of James Rennell published her father's "Investigation on the Subject of the Currents of the Atlantic Ocean." To Mr. Rennell, who had devoted his life to the subject of geography, and particularly to ocean currents, was given the task of compiling the data which had for many years been collected by the British Admiralty office. He adopted Franklin's theory as to the principal cause of ocean currents. He claimed, moreover, that there existed a change in the position and breadth of the column of warm water from time to time, which changes were sometimes very sudden and did not follow any regular course of season.

Arago believed, "that with respect to currents, the rotation of the earth ought principally to be taken into view, and that this, together with the cooling and warming of the water in the north and south, is the main cause of their more rapid or slower deviation and progress toward the east or west."

The next attempt to collect data on marine meteorology was made by Lieut. Maury. It is somewhat dif-

ficult to ascertain from his writings exactly what his ideas were as to the cause of the great ocean currents. Lieut. Pillsbury says: "His belief was, in effect, that differences of density caused the main currents, and that this might be modified by winds, rain, barometric pressure, evaporation, and the fauna and flora of the ocean."

The Coast Survey explorations of the Gulf Stream commenced substantially in 1845, under Prof. A. D. Bache; and with brief interruptions have been continued to the present time; under Lieut. (now Commander) C. H. Davis, Lieuts. George M. Bache, S. P. Lee, Richard Bache, T. M Craven, J. N. Maffit, Prof. Henry Mitchell, Robert Pratt, Commander Howell, Lieut. Commander Sigsbee, Commander John R. Bartlett, Lieuts. J. C. Fremont, Jr., and J. E. Pillsbury, all of the U. S. Navy. Each officer has contributed to the knowledge of this interesting question. The conclusions adopted by Prof. Bache from observations taken under his direction between 1854 and 1860 were as follows: "That between Cape Florida and New York the Gulf Stream is divided into several bands of higher and lower temperatures of which the axis is the warmest, the temperature falling rapidly inshore and more slowly outside. That between the coast and the stream there is a fall in temperature so abrupt, that it has been aptly called the 'cold wall.' Inside this wall is another increase, while outside the warmest band which is next the cold wall there is another warm and one other cold band." Concerning the theory of temperatures Lieut. Pillsbury says: "So much has been written on the question in times past, and the belief is so wide-spread at

the present day, that the thermometer may be relied upon to indicate the presence of a current, that I wish to particularly accentuate the fallacy of the idea. . . . I can see no way of utilizing the thermometer for the purposes of accurate navigation, nor indeed of using it to indicate with certainty that the current is favorable or the reverse."

Lieut. Pillsbury concludes that there are two prominent theories; first, surface drift, due to permanent or semi-permanent winds, and, second, gravity, due to the differences of density of sea-water. He says: "I place myself with those who advocate the wind theory as the chief cause of the Gulf Stream proper, and of most ocean currents, but to differences in density we may attribute some variations in surface indications of the current. The prime mover, however, is generally wind, and I think my observations of the currents during the past five years will add much weight to the theory."

Early Chart of Long Island Sound.—Illustration No. 71 in the Coast Survey Report of 1890, just issued, is an elaborate chart of the North American coast from Cape Cod to the Navesink Hills, including Long Island Sound and approaches, constructed probably between the years 1715 and 1720, although there are indications that parts of it had an origin from 20 to 30 years earlier. The chart was recently discovered by Capt. Charles Hervey Townshend of New Haven, in the British Records office. He is of the opinion that it was made by a hydrographical survey party composed of British naval officers.

An examination of the chart affords additional con-

firmation of several now altered hydrographical features. As Captain Townshend remarks: "The chart furnishes positive proof of the existence of one of the closed passages that tradition says existed in early times through Cape Cod, and sustains the statement of Gosnold in 1602 that Cape Cod was then an island. That one of these passages remained open as late as 1717 is shown by a marginal note on the chart. In this very passage, in a salt marsh, has lately been discovered the remains of an ancient ship which was exhumed by the action of the sea May 6, 1863. It lay within the lands of what is now the town of Orleans." On the authority of Capt. William Foster of Brewster, Mass., Capt. Townshend states that the passages were closed about 150 years ago during a furious wind gale accompanied by a tidal wave, depositing sand hills sixty feet high in the salt marshes and lowlands.

Other changed features are: (1) The islands of Nantucket and Martha's Vineyard are shown as six islands. (2) The Rose and Crown Shoal, then marked "dry," has at this date (1891) twelve feet of water over it. (3) Across the east entrances of Long Island Sound are given the names of numerous islands—Fisher's, Gull, and Plum—forming with sunken reefs a continuous chain. (4) The connection of Governor's Island with Long Island by a narrow sand spit.

BERING'S FIRST VOYAGE.—Mr. William H. Dall's translation* of Vasili Bergh's abstract of Peter Chaplin's journal of Bering's first voyage to the region that

* Appendix No. 19, Annual Report of the U. S. Coast and Geodetic Survey 1890. 4to. Washington, 1891. 18 pp., 2 maps.

now bears his name is an important addition to geographic literature. Mr. Dall has already published a translation of Capt. Bering's official report,* which previously was accessible only in the Russian tongue and in a rare and little-known periodical. Bergh found this journal of Chaplin in the archives of the Imperial Naval College, of which Chaplin was a cadet. From this, and other sources, he compiled a history of the voyage which was printed at St. Petersburg in 1823,† in the Russian language. The book is now exceedingly rare, not more than three or four copies being known.

The expedition, of which Chaplin's journal ‡ contains the narrative, was instigated and directed by Peter the Great under the following characteristic instructions to Capt. Bering:

(1) There shall be built on the Kamchatka, or at some other place adjacent, one or two boats with decks.

(2) With these boats, to sail along the coast which extends northwards and which is supposed (since no one knows the end of it) to be continuous to America.

(3) And therefore to seek the point where it connects with America, and to go to some settlement under European rule; or, if any European vessel is seen, to learn of it what the coast visited is called, which should be taken down in writing, an authentic account prepared, placed on the chart, and brought back here.

According to Mr. Dall the expedition crossed northern Asia with wagons, barges, boats, sledges, or packhorses, observing latitude and variation of the compass

* Nat. Geographic Mag. Vol. 2, pp. 111–169.

† First sea voyages of the Russians, undertaken for the settlement of this geographical problem—Are Asia and America united?—and performed in 1727–'28–'29, under the command of fleet-captain of the first rank, Vitus Bering. To which is added a short biographical account of Captain Bering and some of his officers. St. Petersburg, at the Imperial Academy of Sciences, 1823. 8vo, 3 prel. l. iv., 126 pp., 1 table, 1 map.

‡ This journal is deposited in the archives of the Naval College of the Admiralty in St. Petersburg. Chaplin is said to have died at Archangel in Russia, in 1764, having attained the rank of Captain-Commander.—*Dall.*

when possible, and working out the longitude by the computation of directions and distances. They built a vessel at Okhotsk and transported themselves across the Okhotsk Sea to the western shore of Kamchatka; carried their stores by boat and sledges across that peninsula; built another vessel, in which they sailed northward along the coast to Bering Strait, and then returned to Kamchatka without success; then circumnavigated the southern part of that peninsula and returned to Okhotsk, and thence to St. Petersburg. The time occupied was from January 24, 1725 to March 12, 1730.

After Bering's arrival in St. Petersburg, we are informed that he made a recomputation and revision of his data, and that the final chart was prepared at Moscow in 1731. This map, so interesting from its bearing on the geographical history of America and the progress of discovery, has never as a whole, until now, appeared in print; and it is only through the enlightened liberality of Baron Robert Klinckofström, of Stafsund, Sweden, who permitted this valuable relic to go beyond the seas, that American students, thanks to Prof. Dall and the Coast Survey, are now in full possession of this important document.

The original map measures 51 by 21 1-8 inches. The title, in a fine ornamental escutcheon, reads in translation: *Geographic chart from Tobolsk to the Chukchi* [Cape], *made during the Siberian Expedition under the command of Fleet-Captain* [a blank space]. The blank space in another known copy is filled in with *Bering*. It is in black and white, the mountains marked in, the only color being small green trees show-

ing wooded country. There are quite a number of ethnological, topographic, hydrographic and magnetic details. The ornamental escutcheon is evidently drawn by a different hand in another kind of ink.

DESCRIPTION OF THE COAST SURVEY WORK.—No clearer exposition of the objects, scope, methods, means, rate of progress, and prospective views of the Coast and Geodetic Survey could be presented than that contained in the address of Mr. George Davidson at the ninth conference of the International Geodetic Association in Paris.*

The publications of the Survey have not been so numerous as would seem desirable, but their scope is wide, as is seen in the descriptions of total solar eclipses observed by its officers; in the observations of the transits of Venus in 1874 and 1882; in the recovery of the French station of the transit of Venus in 1769 at San José del Cabo, in Lower California; in the research upon the first landing place of Columbus; in the examination of the voyages of Ulloa, Cabrillo, Ferrelo, Vizcaino, and Drake on the Pacific coast between 1539 and 1603; in the report upon the irrigation systems of India, Egypt and Italy.

The practical character of its work is shown in the Coast Pilots, and in the Charts.

THE FISHING STREAMS AND LAKES OF WESTERN MONTANA AND YELLOWSTONE PARK. Prof. B. W. Evermann has done good service in his graphic delineations of the sportsman's paradise in Western Montana, con-

* Appendix No. 17, Annual Report of the U. S. Coast and Geodetic Survey, 1890. 4to, Washington, 1891. 16 pp.

tained in Senate Mis. Doc. No. 65, 52d Congress, 1st session.* He describes the locations and general characters of sixty-eight streams and lakes, their size, depth, current, source, course, temperature, clearness, etc. Discussions of the forests and other vegetation are given in detail in connection with the description of each stream or particular locality examined. What makes this narrative of special value is that it is accompanied by an itinerary.

Speaking of Swan Lake, distant from Flathead Lake about seven miles, though the distance by the river is three times as great, he says: "This beautiful lake, sixteen miles long, and varying from less than a mile to three miles in width, with its clear and sparkling waters, surrounded on all sides by dense evergreen forests, and studded here and there with small well wooded islands, rivals in beauty and picturesqueness any that the writer has ever seen; and the beauty of the river from the lake to the outlet is unexcelled. The lake is said to be a favorite resort for swans, ducks, and geese. The fishes of Swan Lake and Swan River are the common trout, salmon trout, whitefish, Columbia chub, squawfish, blob, and the Columbia River sucker. Swan River is noted as one of the best trout streams in Montana."

The party visited also the several lakes known collectively as Dempsey's Lakes, lying at an elevation of about 9,000 feet above the sea, around the base of the rocky peak of Mount Powell. In the third lake, he says: "We found trout most abundant. As a result

* Report of the Commissioner of Fish and Fisheries respecting the establishment of fish-cultural stations in the Rocky Mountain region, etc. Washington, 1892, 8vo, 88 pp., 36 plates.

of less than two hours' fly-fishing, we took about one hundred and twenty-five, each weighing a half pound or less. It seemed to matter very little what was used for bait. Several good catches were made with bright colored leaves. All were caught in shallow water along the shore."

An interesting part of this paper is a new description of Two-Ocean Pass, located about long. 110° and lat. 44° 05′. "Standing upon the bank of either fork of Atlantic Creek, just above the place of the 'parting of the waters,' we tossed chips, two at a time, into the stream. Though the two chips would strike the water within an inch or so of each other, not infrequently one would be carried by the current to the left, keeping in Atlantic Creek, while the other might be carried a little to the right and enter the branch running across the meadow to Pacific Creek; the one beginning a journey which will finally bring it to the Gulf of Mexico, the other entering upon a long voyage in the opposite direction, to the Pacific. . . . During the night that we camped in Two-Ocean Pass (August 17–18) ice froze half an inch in a basin at our camp, and nearly as thick on a creek near by."

This pass was first mentioned by Capt. W. F. Reynolds in 1868. Capt. Jones (U. S. Engineers) described it in 1875, Dr. Hayden visited it in 1878, and Mr. Arnold Hague in 1884. Capt. Jones' and Dr. Hayden's maps of the region, also a modified drawing by Prof. Evermann, accompany this paper. The report contains besides a number of most interesting views of this little known territory.

PALEONTOLOGY IN CONGRESS.—Those gentlemen in and out of Congress who are unfriendly to the administration of the Government Geological Survey, had at least a temporary advantage in the recent discussion in the House of Representatives over the appropriations for the Survey for the next fiscal year.

On the motion of Representative Herbert, of Alabama, the paragraph in the appropriation bill making provision for paleontological work and the salaries of the paleontologist (Prof. O. C. Marsh) and assistant was stricken out, and in lieu thereof the following inserted :

" Provided, that after the 1st day of July, 1892, the Geological Survey shall not expend any money for paleontological work or researches."

Mr. Herbert, asserting that the chief work of the Survey was the construction of a geological map, and that paleontological work was not even necessary to the proper construction of such a map, inquired of what use the map would be when constructed? He claimed that it would cost $20,000,000, and that no man within the reach of his voice would ever see it completed, and that paleontology, paleobotany and even general researches into the science of geology are of no value whatever to the surveys which are intended to aid in the irrigation of our western country. Holding up a copy of Prof. Marsh's monograph on the *Odontornithes*, he said: " When you came to examine the book you found that it was simply going back to the past ages to show that at some prehistoric period of the world there existed birds of a certain type which had teeth. Such are the scientific problems we are

paying these immense sums year after year to investigate." Mr. McMillan thought that money should not be expended "in hunting up bugs that are living on the fossiliferous carcasses of those that were dead before the flood."

The protest of the Director, Major Powell, produced no effect. In a letter to Representative Bingham, he said: "The paleontologic researches are imperatively necessary to the investigations carried on by the Geological Survey. It is impossible to classify the geologic formations of the country, to represent the same upon maps and to make a proper report, therein exhibiting the mineral values which they contain, unless these paleontologic investigations are made. Everywhere in America, in Europe, and even in Japan, geological surveys depend fundamentally upon paleontology. The geological formations are identified and known by the fossils which they contain, and it is not possible to make a geological survey without considering the facts thus brought to light. If in a lawsuit, by some misconception of legal practice, it should be decided to exclude evidence and to use only legal arguments in the trial of the case, a fair illustration would be afforded of excluding paleontologic researches from geologic investigations." Major Powell concluded with the remark that the Geological Survey had the most expert and thoroughly prepared corps of paleontologists ever organized in the world.

Mr. Holman, the chairman of the Committee on Appropriations, said, that a government like ours should keep abreast with the other progressive nations in scientific research. He thought that we kept well up,

and as far as expenditure is concerned went beyond any other government, unless it might be France.

The "salary of the paleontologist" which the popular branch of Congress proposes to abolish, because it is a needless and wasteful expenditure of public money, is thus accounted for by the distinguished gentleman who has been the recipient of it.* "My connection with government work was not of my own seeking, but since I have been on the Geological Survey I have given my whole time to its service and have received no salary from any other source. Moreover, although my own means are limited, I have expended on the work in hand the greater part, if not all, the salary received from the Survey [$4,000]. Let me add that the pecuniary value alone of the vertebrate fossils I have collected for the Government far exceeds the amount expended on my division of the Geological Survey." Concerning the monograph on the *Odontornithes* he says that for the preparation of the volume, involving several years' work and several thousand dollars of his own money, he received no compensation whatever. Moreover, the illustrations were furnished at his own expense.

The discussions in Congress relating to the Geological Survey occurred between May 19 and 25. There appeared in April a pamphlet printed in Cambridge, Mass., entitled: "The Geological Map of the United States and the United States Geological Survey. By Jules Marcou." This pamphlet is a caustic criticism of the methods of the Survey, and an intemperate arraignment of every one connected with it, from director to

* Prof. Marsh to Hon. J. H. Outhwaite.

doorkeeper. At pages 39–40 occur these passages: "The creation of a Division of Vertebrate Paleontology and the choice of Prof. Marsh were very injudicious and reveal incompetent direction as far as the interest of the geological map is concerned. . . . If the Geological Survey, instead of giving every year the large sum devoted to the division of vertebrate paleontology to only Messrs. Marsh and Newberry, had divided it equally among all the vertebrate paleontologists of the United States, it would have been simple justice to such able and good observers as Messrs. Cope, Scott, Osborn, Baur and St. John. But by far the best solution is to suppress entirely the division of vertebrate paleontology."

The Institute of France recently awarded the Cuvier prize for 1891 to the collective work of the Geological Survey of the United States. The Committee of the Institute in making the award said: "Under the powerful impulse which the Federal Government has given it, the geologic service of the United States has produced in twenty-five years results very considerable and very skilfully attained. It must be said that in no other region of the globe have such discoveries been made in so short a space of time."

MAP OF ELEVATIONS.—The United States Geological Survey has recently issued a map of the United States showing the relief of the surface by means of shades of color. This map, which is compiled by Mr. Henry Gannett, is 31x20 inches; the scale is 110 miles to the inch. It distinguishes the areas below 100 feet, 100 to 500, 500 to 1,000, 1,000 to 2,000, 2,000 to 5,000,

5,000 to 8,000, 8,000 to 11,000 and above 11,000 feet. Although necessarily greatly generalized, this map expresses admirably the great features of relief of the country, in a manner never before attempted upon this scale, and is a notable contribution to the geography of the country. It should be distributed to all the schools in the land.

MOTHER MAPS.—The "mother" maps of the world, or at least as many of them as can be found in Washington, were recently brought together for public exhibition, through the instrumentality of the National Geographic Society. The map-collecting and map-publishing bureaus of the Government contributed specimens, excepting the Library of Congress, which probably has the most valuable if not the most extensive collection here. Of contributing bureaus, the U. S. Geological Survey had the greatest wealth, but other offices exhibited charts and maps of great scientific and historic value. It was a novel display at least, and suggests the educational value of a permanent exhibition of the kind where space and light might be liberally contributed—say, for instance, in the new building for the government library. Displays of all kinds are in prospect when that great building is completed. Could one be more instructive than that of the great maps of the world, from their earliest inception?

H.